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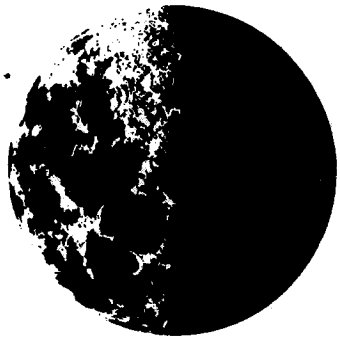
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APOLLO SYSTEMS ENGINEERING MANUAL
Service Module and Adapter Structure

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19 February 1964

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SPACE and INFORMATION SYSTEMS DIVISION

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FOREWORD

This manual is one in a series of special Apollo Engineering Manuals (DIM's 1 through 18) which furnish a contemporary source of design and system information, and descriptions for the Apollo spacecraft. This manual, DIM-9, contains basic information, by use of text and illustrations, on the components of the service module and adapter structures.

Illustrations include: a. over-all configuration control drawings of both service module (S/M) and adapter; b. detail drawings of component parts; c. installation drawings; d. interface control drawings, when available.

The structural components of the service module and the adapter are designed to operate within design limitations while subjected to environmental restrictions imposed by the NASA Exhibit "B" Technical Specification, Part I, dated 3 January 1963.

A final manual can not be consummated at this time. Expanding, dynamic, and involved technology of the subject matter permits the issuance only of pertinent information on an as-known basis. When relevant data appear, revisions will be in order.

The service module and adapter structures Manual Review Board is composed of, but not limited to, the following personnel:

Chairman:	J.R. Cole, Chief Service Module Design	696-420
Alternate:	To be determined	
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The following lead engineers can give more definite information on, and answers to, technical questions in their areas of specialization:

H. W. Myers - Spacecraft LEM Adapter

D. M. Robison - S/M Structure

E. G. Stecki - S-1 Adapter; Mounting Provisions for S/M and Adapter

T. Bucuvalas - Service Propulsion System, Main Tanks

K. C. Dullea - Mounting Provisions for Environmental Control and Electrical Power Systems

B. F. Glienke - Mounting Provisions for Reaction Control System, Service Propulsion and Pressurization Systems

J.R. Cole, Chief
Apollo Service Module Design

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1.0 INTRODUCTION

1.1 General

1.1.1 The Apollo service module is pictured in the layout V17-933200, "Service Module Nomenclature" (Figure 1-1). This layout provides names and basic details of the S/M, the fairing, and the adapter. Drawing V17-000002 (Figure 1-2) is a perspective of the S/M general assembly.

1.1.2 This design information manual (DIM) presents the structure of the S/M, the adapters, the tanks of the service propulsion system (SPS), the mounting provisions of the S/M systems, the significant interfaces.

1.1.3 The systems of the S/M for which mounting provisions must be designed are: the SPS, including the S/M aft heat shield; the reaction control system (RCS) plus its heat shields; the environmental control system (ECS); the electrical power system (EPS); the telecommunication system (T.S.); and the internal insulation system (IIS).

1.2 Reliability

1.2.1 Information furnished by the Reliability Engineering Group for this manual is classified, but DIM-9 is unclassified. Hence, reliability information, advice, or completed studies may be obtained by contacting Department 643-50.

2.0 SERVICE MODULE STRUCTURE

2.1 General and Configuration

2.1.1 The service module structure consists of the outer shell, radial beams, forward and aft bulkheads, and inner web. (See 7.2.1 for analysis of the fairing.) Drawing V17-320001 (Figures 2-1 through 2-6) depicts the structural assembly of the S/M.

2.1.2 The definition of the present S/M configuration required studies in space allotment for its systems and equipment. Design criteria were the factors of access, removal, and servicing. Both structural design and choice of materials were based on the exigencies of space environment.

2.1.3 The S/M is 155 inches long and 154 inches in diameter. The outer shell is made of one-inch aluminum honeycomb sandwich; the radial beams of aluminum plate are made by numerically controlled machining, followed by chem-milling; forward and aft bulkheads are fabricated from aluminum honeycomb; and the inner web is made of aluminum sheet.

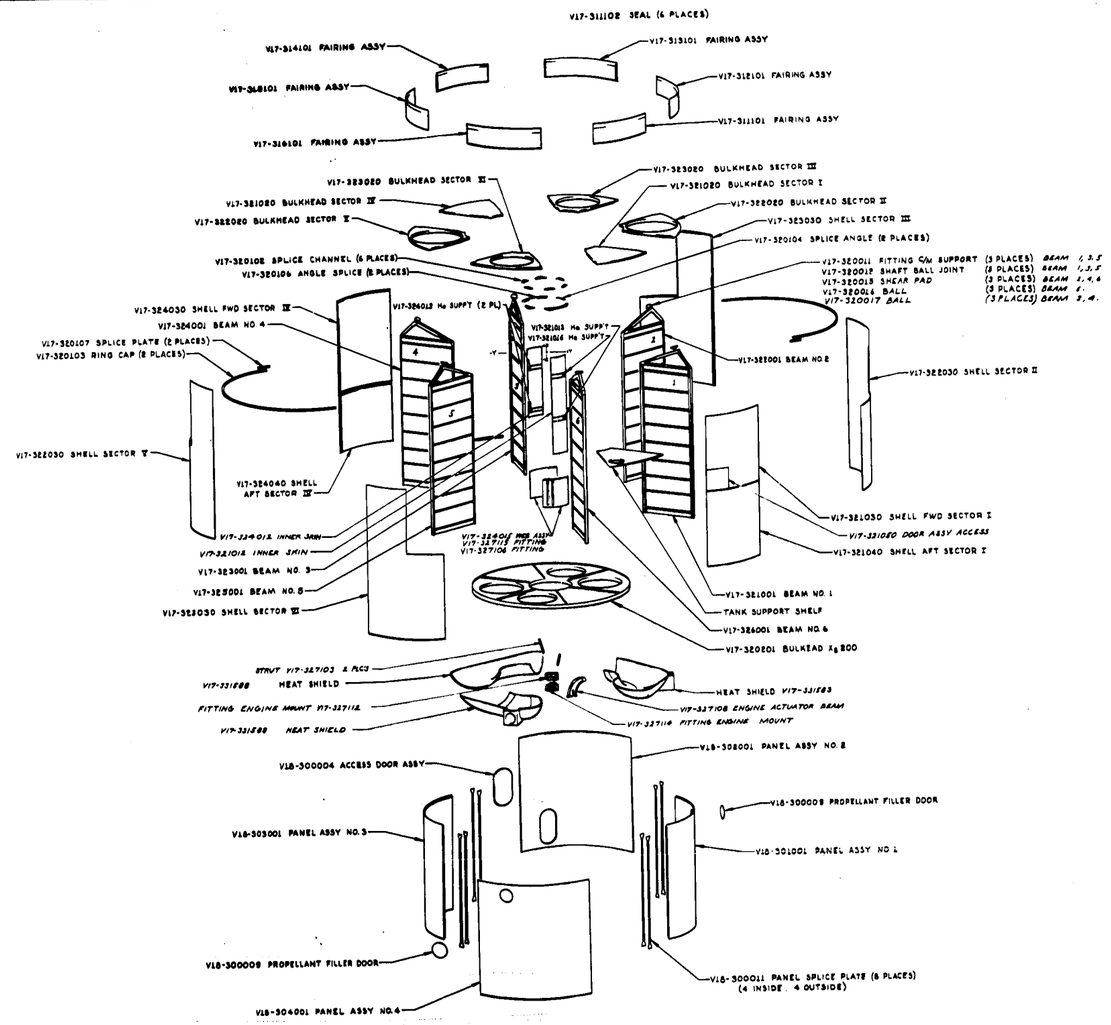
2.1.4 The six radial beams divide the interior of the S/M into three pairs of diametrically opposed sectors which are unevenly sized. Design layout V17-935561 (Figures 2-7 through 2-8) illustrates the complete interior arrangement of the S/M. A center section which is 44 inches in diameter extends the length of the S/M.

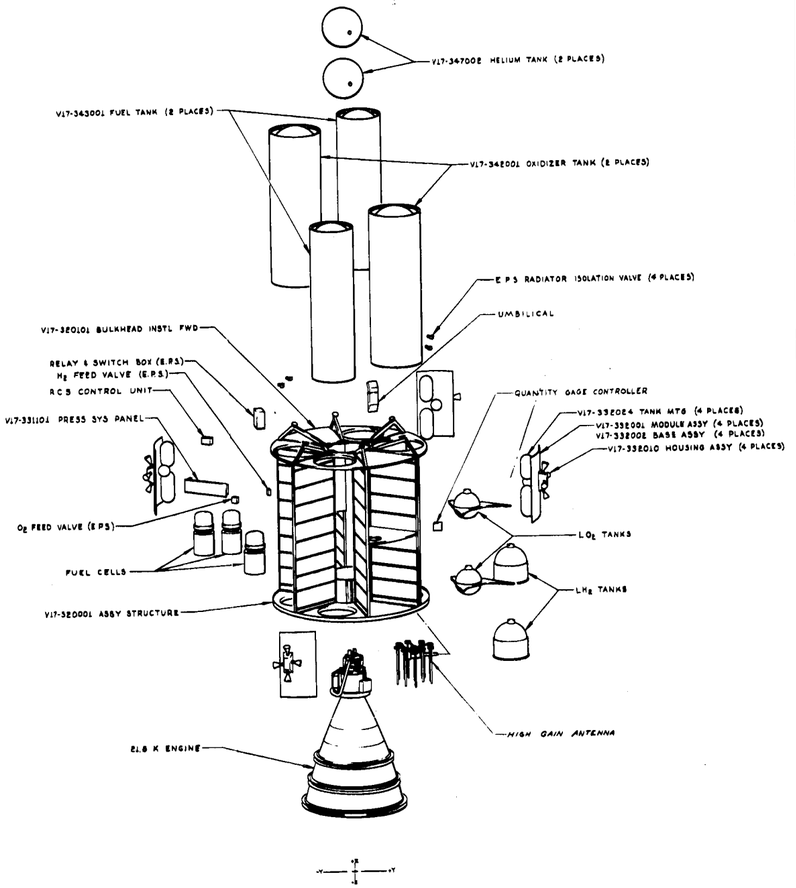
2.1.5 The function of the S/M is threefold: a) support of the main engine of the SPS; b) housing of the SPS propellant tanks; c) housing of all other systems not contained in the command module (C/M) but required for the spacecraft (S/C) mission.

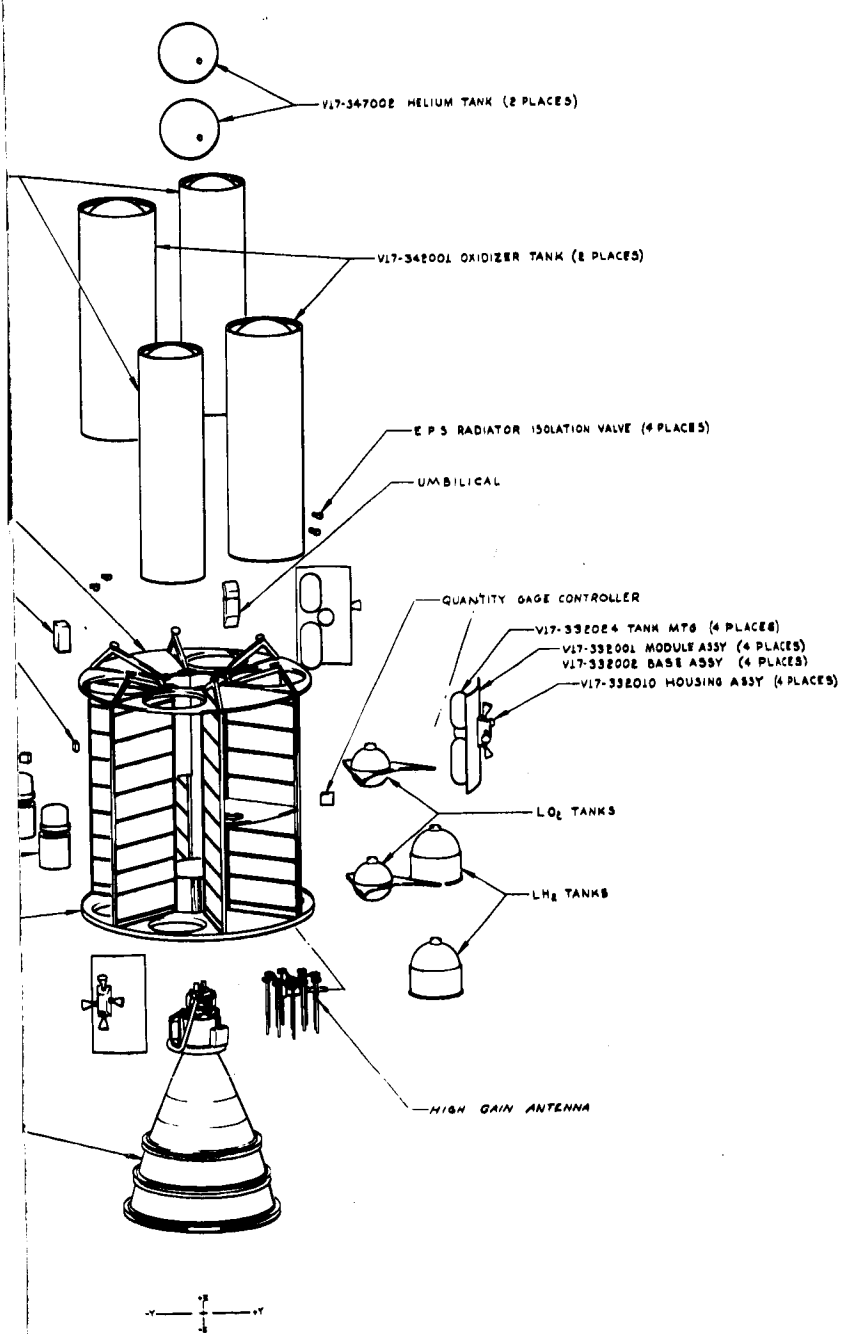
2.2 Component Description and Function

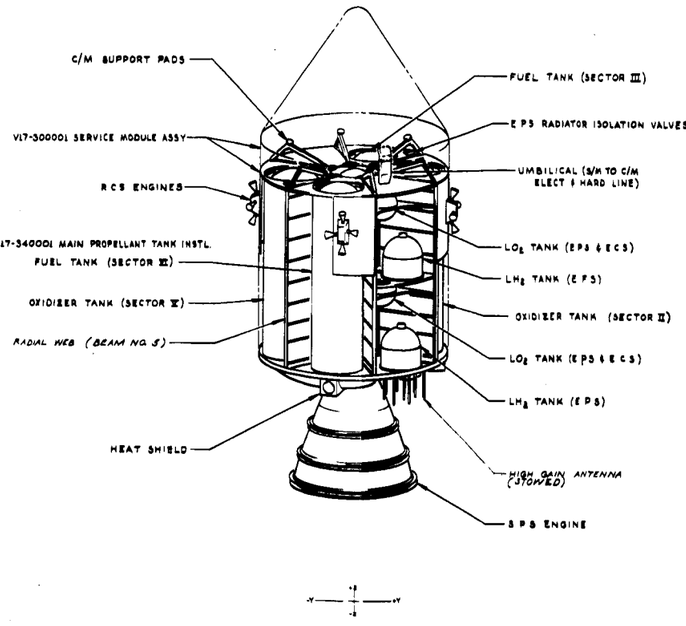
2.2.1 The outer shell of the S/M is formed by bonded one-inch aluminum honeycomb sandwich panels. This material was chosen for fabrication of the outer shell because it provides the greatest amount of strength and rigidity for the least amount of weight. In addition, its simplified structure reduces the number of parts needed, handling, and inspection. Also, reliability is increased.

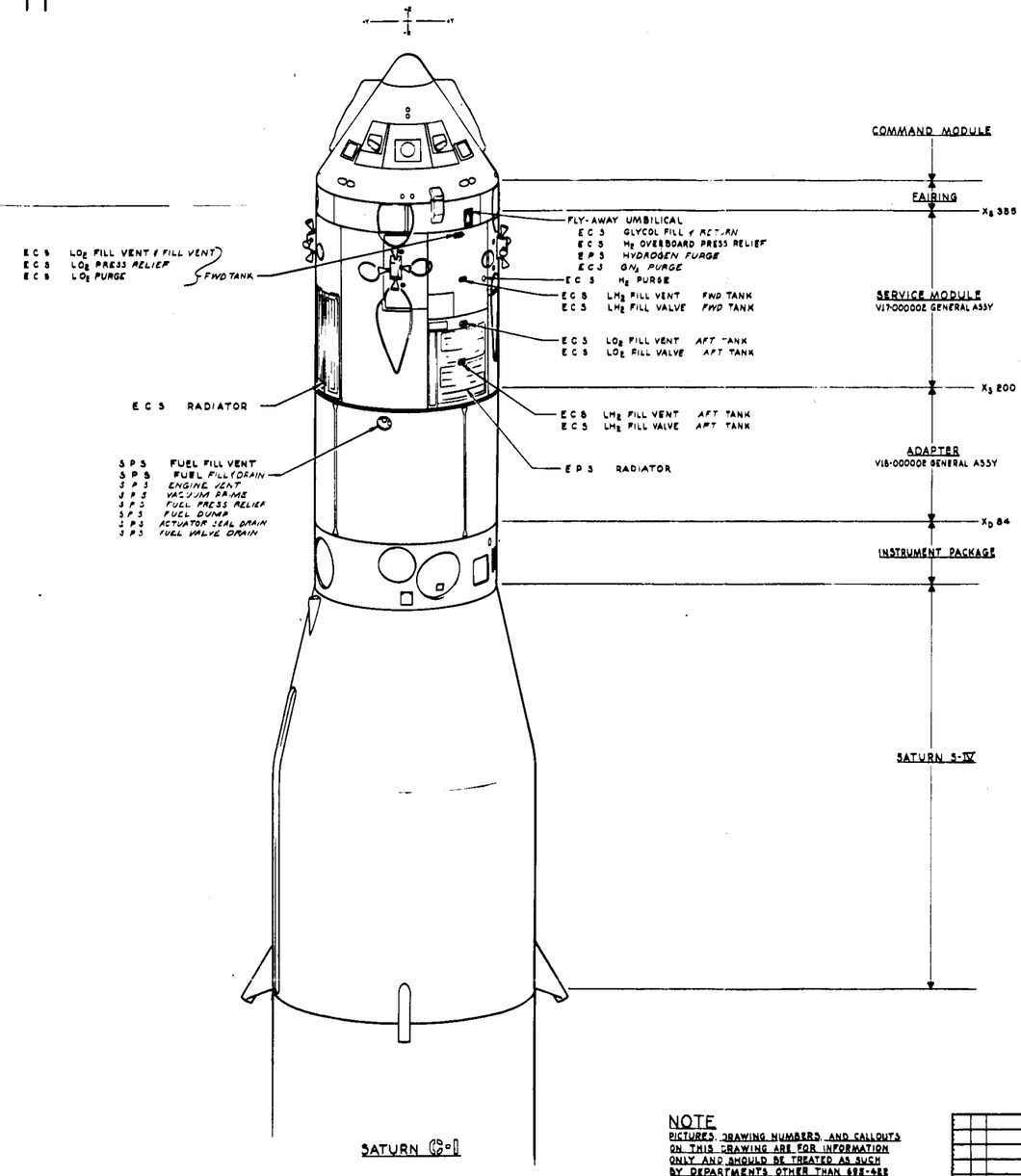
2.2.2 The outer shell of the S/M contains the space radiators (ECS and EPS) which form an integral part of the outer face sheets of the aluminum honeycomb sandwich panels. It also supports the four RCS modules. It distributes the C/M and S/M equipment loadings from the radial beams into the S/C booster. In addition, it resists aerodynamic pressures, provides a clean aerodynamic shape, and protects the S/M interior from external environment.


V17-311102 SEAL (6 PLACES)
V17-314101 FAIRING ASSY
V17-313101 FAIRING ASSY
V17-312101 FAIRING ASSY
V17-311101 FAIRING ASSY
V17-316101 FAIRING ASSY
V17-323020 BULKHEAD SECTOR III
V17-321020 BULKHEAD SECTOR I
V17-322020 BULKHEAD SECTOR II
V17-323030 SHELL SECTOR III
V17-320104 SPLICE ANGLE (8 PLACES)
V17-320011 FITTING C/M SUPPORT (3 PLACES) BEAM 1, 3, 5
V17-320012 SHAFT BALL JOINT (8 PLACES) BEAM 1, 2, 3
V17-320013 SHEAR PAD (3 PLACES) BEAM 2, 4, 6
V17-320016 BALL (3 PLACES) BEAM 6
V17-320017 BALL (3 PLACES) BEAM 2, 4
V17-323020 BULKHEAD SECTOR IV
V17-322020 BULKHEAD SECTOR V
V17-320108 SPLICE CHANNEL (6 PLACES)
V17-320105 ANGLE SPLICE (8 PLACES)
V17-324030 SHELL FWD SECTOR IV
V17-324001 BEAM NO. 4
V17-320107 SPLICE PLATE (8 PLACES)
V17-320103 RING CAP (8 PLACES)
V17-322030 SHELL SECTOR V
V17-324013 He SUPPT (2 PL)
V17-321018 He SUPPT
V17-321014 He SUPPT
V17-321001 BEAM NO. 2
V17-322030 SHELL SECTOR II
V17-324040 SHELL AFT SECTOR IV
V17-324012 INNER SKIN
V17-321018 INNER SKIN
V17-323001 BEAM NO. 3
V17-325001 BEAM NO. 5
V17-322030 SHELL SECTOR VI
V17-324015 MOR ASSY
V17-327115 FITTING
V17-327106 FITTING
V17-321030 SHELL FWD SECTOR I
V17-321050 DOOR ASSY ACCESS
V17-321040 SHELL AFT SECTOR I
V17-321001 BEAM NO. 1
TANK SUPPORT SHELF
V17-326001 BEAM NO. 6
V17-322021 BULKHEAD Fig 200
STRUT V17-327103 2 PLCS
V17-331688 HEAT SHIELD
FITTING ENGINE MOUNT V17-327112
V17-331688 HEAT SHIELD
HEAT SHIELD V17-331683
V17-327108 ENGINE ACTUATOR BEAM
V17-327119 FITTING ENGINE MOUNT
V18-300004 ACCESS DOOR ASSY
V18-302001 PANEL ASSY NO. 2
V18-300008 PROPELLANT FILLER DOOR
V18-303001 PANEL ASSY NO. 3
V18-301001 PANEL ASSY NO. 1
V18-300008 PROPELLANT FILLER DOOR
V18-300011 PANEL SPLICE PLATE (8 PLACES)
(4 INSIDE, 4 OUTSIDE)
V18-304001 PANEL ASSY NO. 4

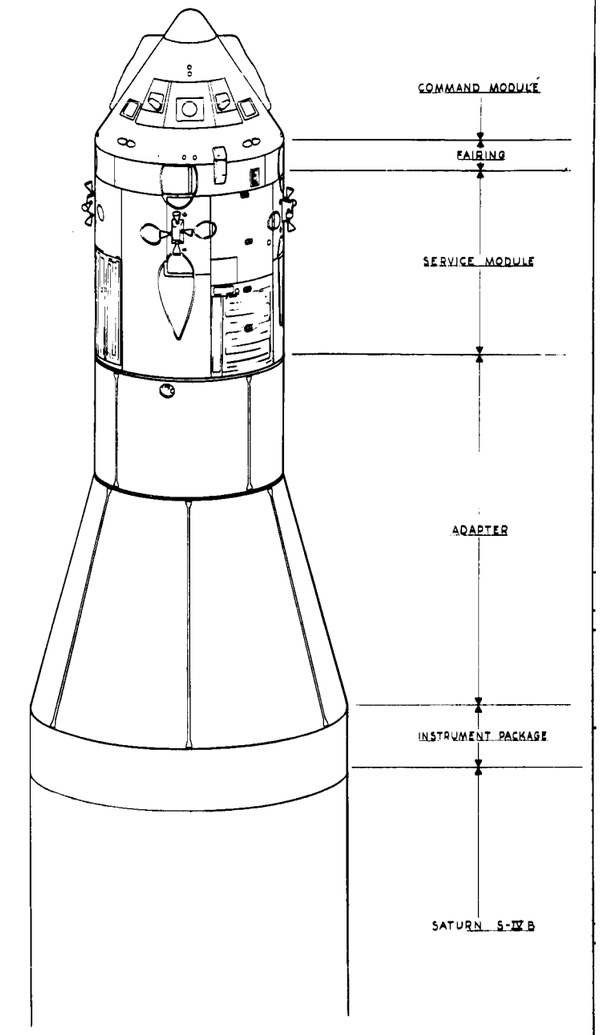

V17-347002 HELIUM TANK (2 PLACES)
V17-343001 FUEL TANK (2 PLACES)
V17-342001 OXIDIZER TANK (2 PLACES)
E.P.S. RADIATOR ISOLATION VALVE (4 PLACES)
UMBILICAL
V17-320101 BULKHEAD INSTL FWD
RELAY & SWITCH BOX (E.P.S.)
H2 FEED VALVE (E.P.S.)
R.C.S. CONTROL UNIT
V17-331101 PRESS SYS PANEL
QUANTITY GAGE CONTROLLER
V17-332004 TANK MTG (4 PLACES)
V17-332001 MODULE ASSY (4 PLACES)
V17-332002 BASE ASSY (4 PLACES)
V17-332010 HOUSING ASSY (4 PLACES)
O2 FEED VALVE (E.P.S.)
LO2 TANKS
FUEL CELLS
LH2 TANKS
V17-320001 ASSY STRUCTURE
HIGH GAIN ANTENNA
21.8 K ENGINE


V17-347002 HELIUM TANK (2 PLACES)
V17-342001 OXIDIZER TANK (2 PLACES)
E P S RADIATOR ISOLATION VALVE (4 PLACES)
UMBILICAL
QUANTITY GAGE CONTROLLER
V17-332004 TANK MTG (4 PLACES)
V17-332001 MODULE ASSY (4 PLACES)
V17-332002 BASE ASSY (4 PLACES)
V17-332010 HOUSING ASSY (4 PLACES)
LO_2 TANKS
LH_2 TANKS
HIGH GAIN ANTENNA





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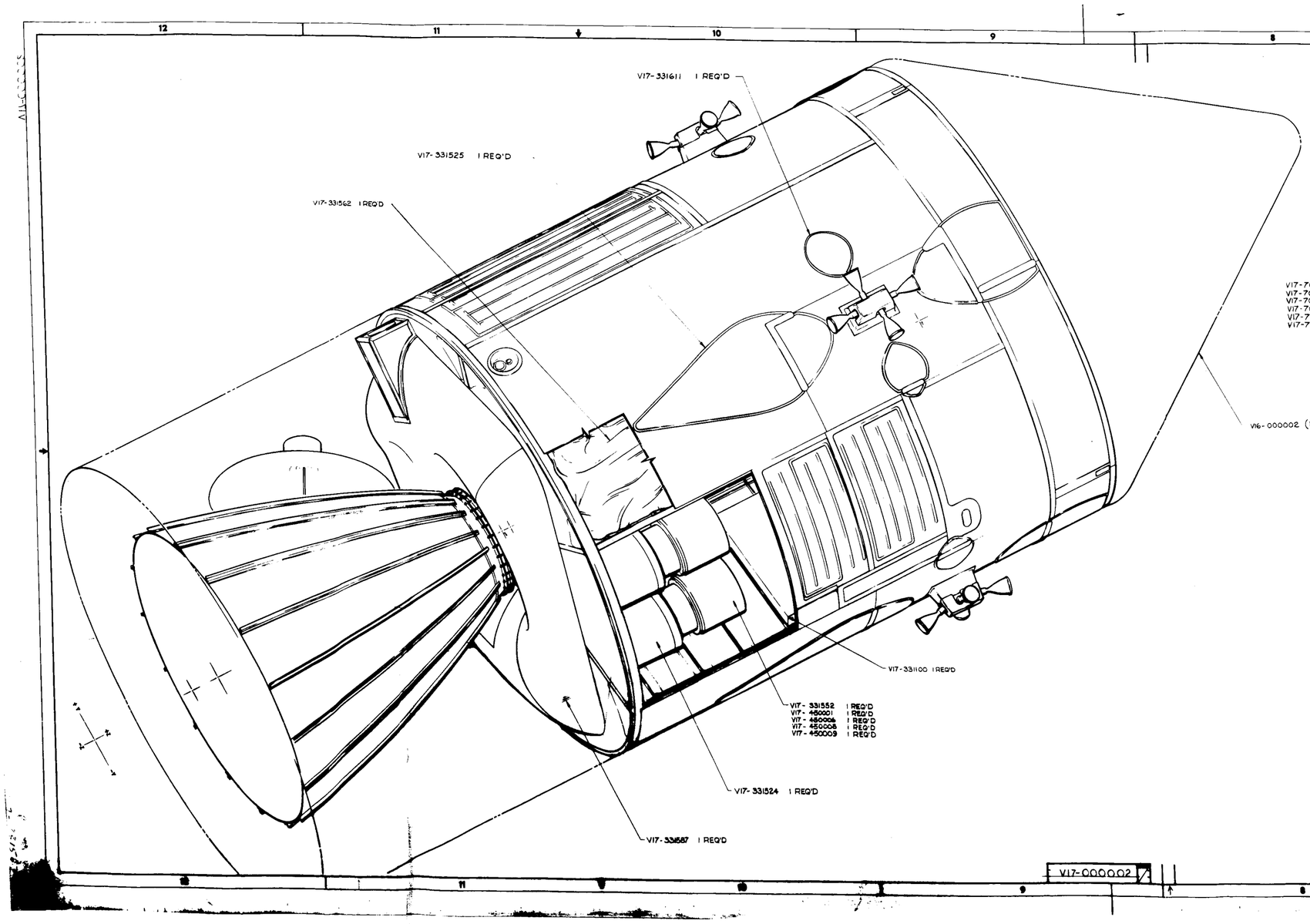
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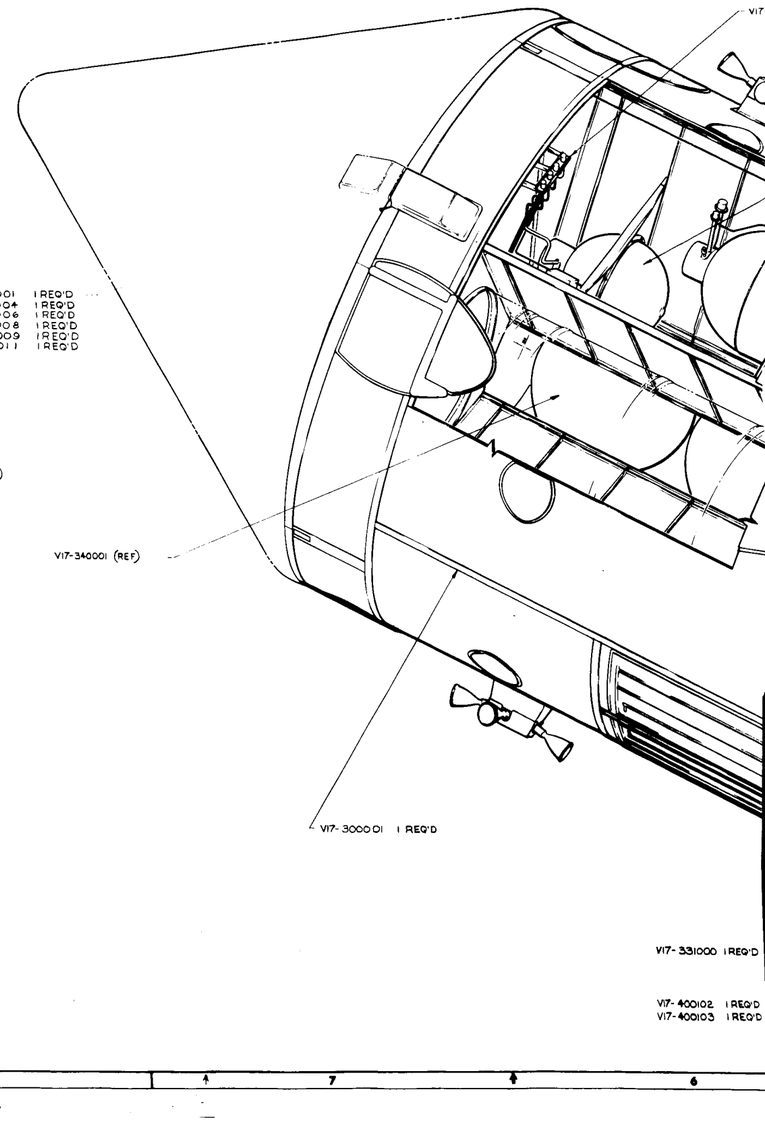
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SERVICE MODULE NOMENCLATURE	
DOCK IDENT NO	03953
SIZE	J
V17-933200	

V17-933200

Figure 1-1. Service Module Nomenclature (V17-933200)


V17-331611 1 REQ'D
V17-331525 1 REQ'D
V17-331562 1 REQ'D
V17-331100 1 REQ'D
V17-331552 1 REQ'D
V17-450001 1 REQ'D
V17-450006 1 REQ'D
V17-450008 1 REQ'D
V17-450009 1 REQ'D
V17-331524 1 REQ'D
V17-331567 1 REQ'D


V17-700001 1 REQ'D
V17-700004 1 REQ'D
V17-700006 1 REQ'D
V17-700008 1 REQ'D
V17-700009 1 REQ'D
V17-700011 1 REQ'D
V16-000002 (REF.)
V17-340001 (REF.)
V17-300001 1 REQ'D
V17-331000 1 REQ'D
V17-400102 1 REQ'D
V17-400103 1 REQ'D

V17-000002

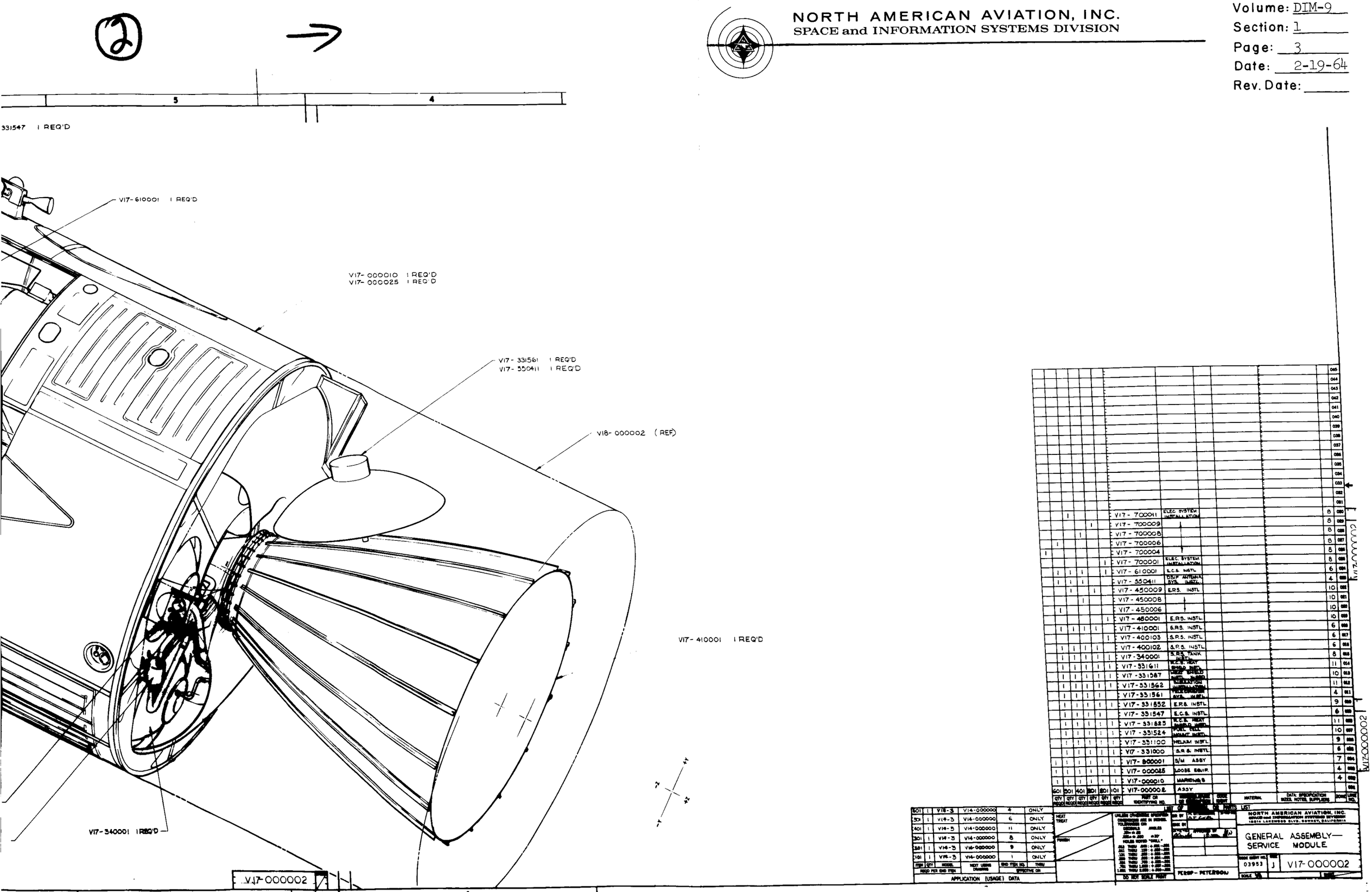
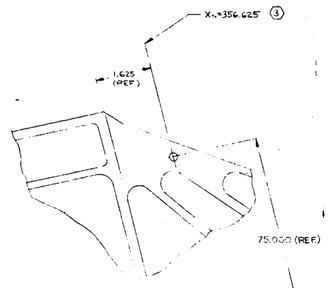
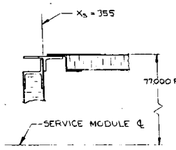


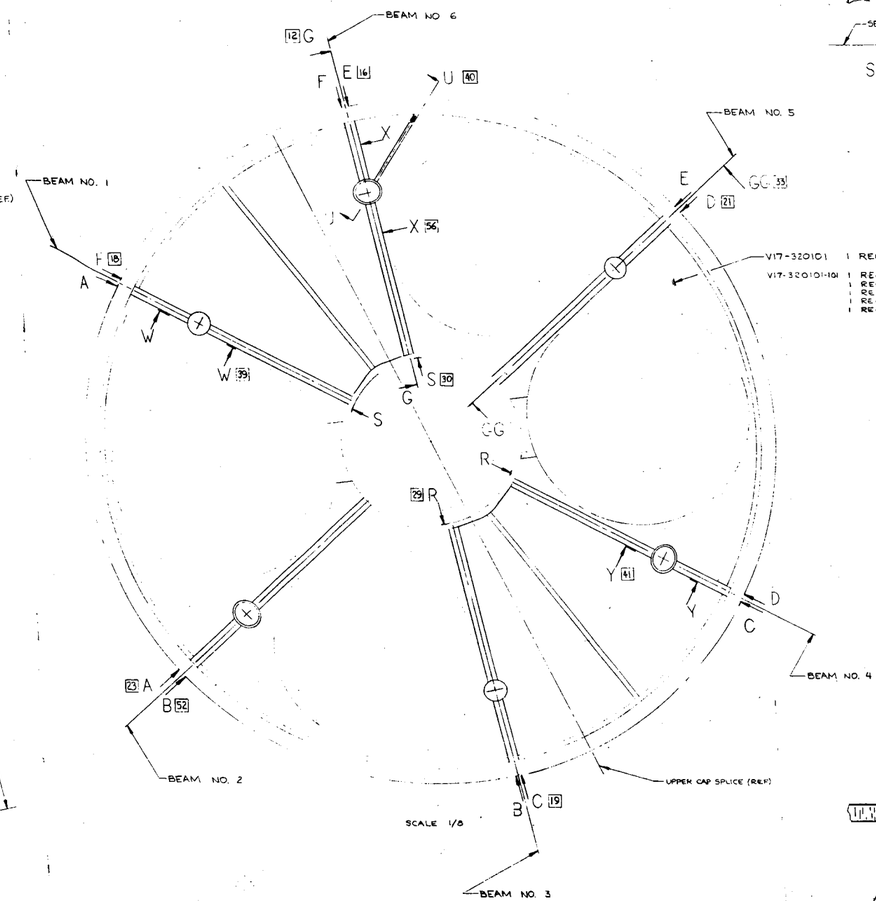
Figure 1-2. Service Module: General Assembly (V17-000002)



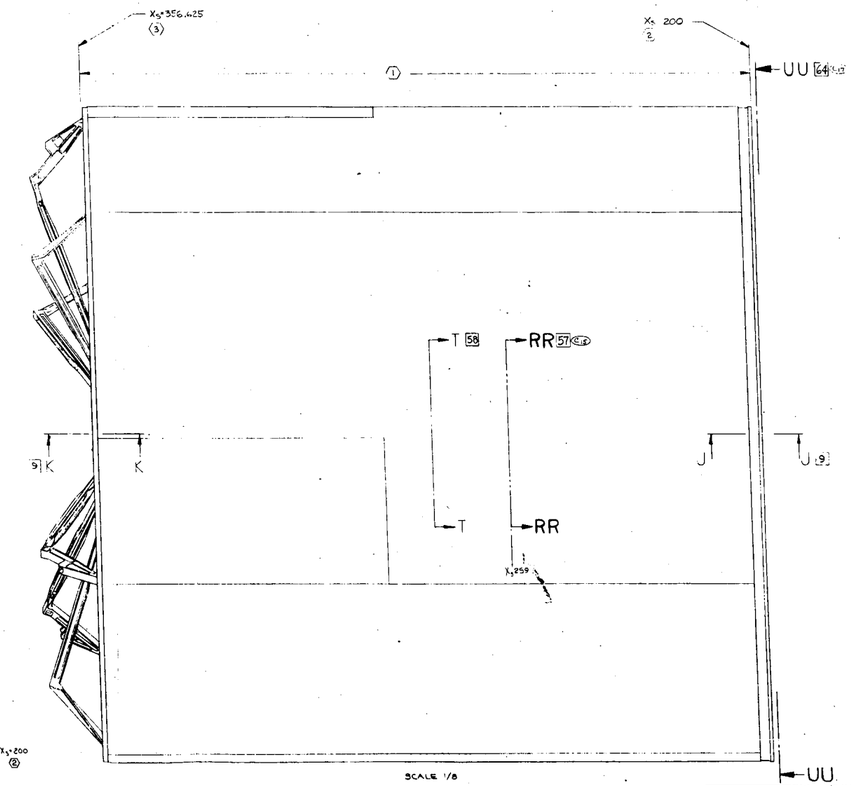
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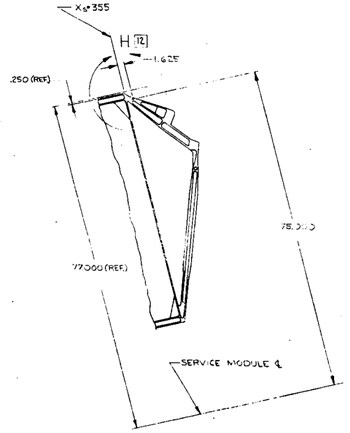
SECT K-K [8]
SCALE 1/2



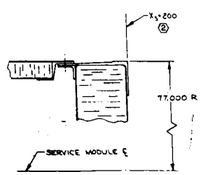
V17-320101 1 REQD ON -101 ASSY
V17-320101-101 1 REQD ON -111 ASSY
1 REQD ON -121 ASSY
1 REQD ON -131 ASSY
1 REQD ON -141 ASSY
1 REQD ON -151 ASSY



SCALE 1/8



SECT. G-G [10]
(TYP BEAM = 2,166)
(A3)
SCALE 1/8



SECTION J-J [7]
SCALE 1/2

TRACEABILITY SYMBOLS
S TRACEABILITY NOT REQUIRED
TS TRACEABILITY BY SERIAL NUMBER (MA0101-0008)
TL TRACEABILITY BY LOT NUMBER (MA0101-0008)

8. SYMBOL ℄ DENOTES EQUAL SPACES
7. INSTALL RIVETS PER MA0101-006
(6) 6. THIS PLANE SHALL BE PERPENDICULAR TO SERVICE MODULE ℄ TO 2.080 (MEASURED AT RADIAL BEAM TOOL HOLES AS SHOWN)
(5) 5. THIS PLANE SHALL BE PERPENDICULAR TO SERVICE MODULE ℄ TO 2.100 (MEASURED AT SERVICE MODULE ML)
(4) 4. TOLERANCE ± .06 BETWEEN STATION PLANES TO BE MEASURED AT SERVICE MODULE ℄
3. INSTALL FASTENERS PER MA0101-005
2. FOR CONTOURS ℄ BEVELS SEE MD-V14
1. STANDARD DETAIL PER MA0101-002
NOTES: UNLESS OTHERWISE NOTED

V17-320001

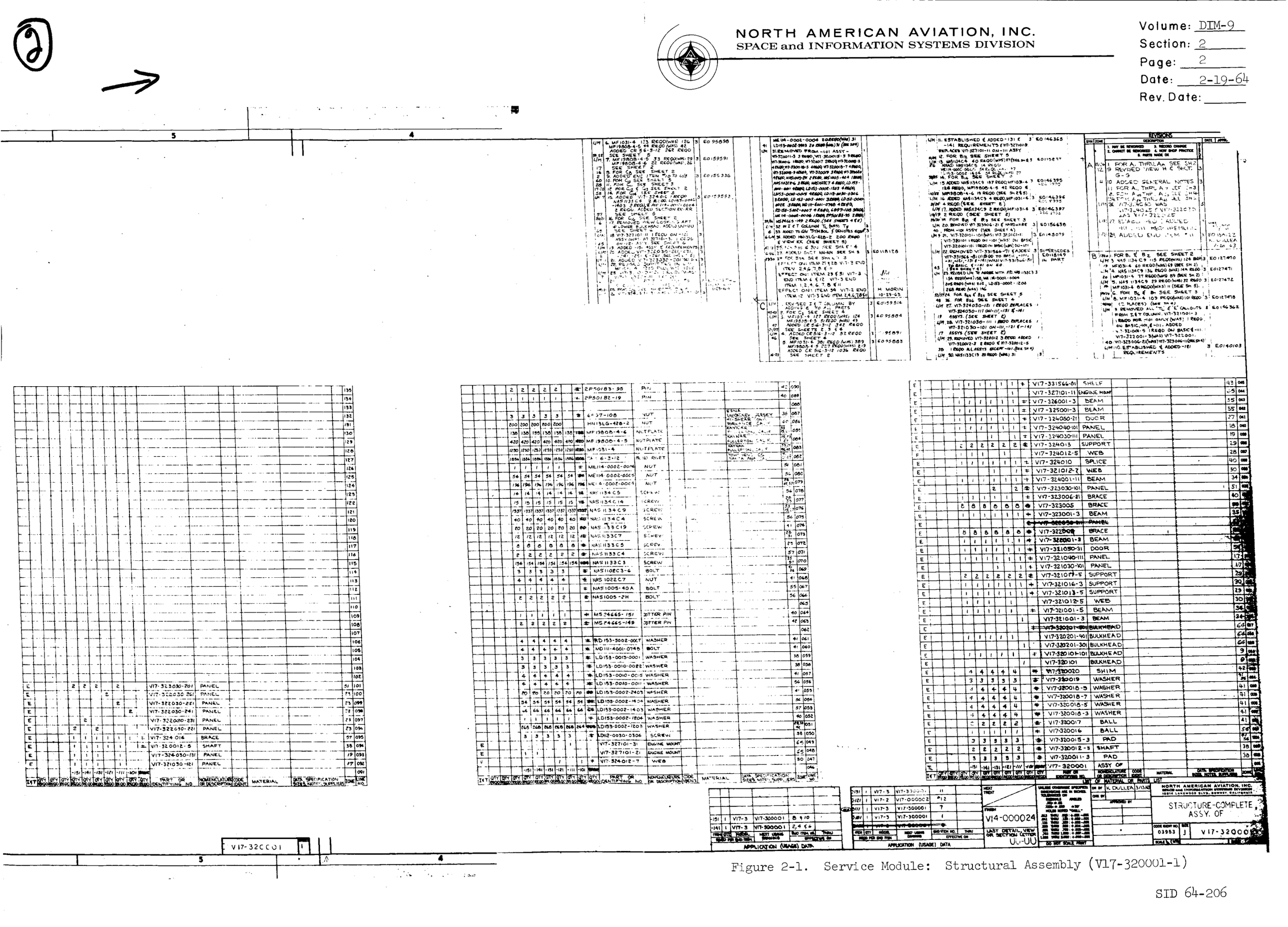
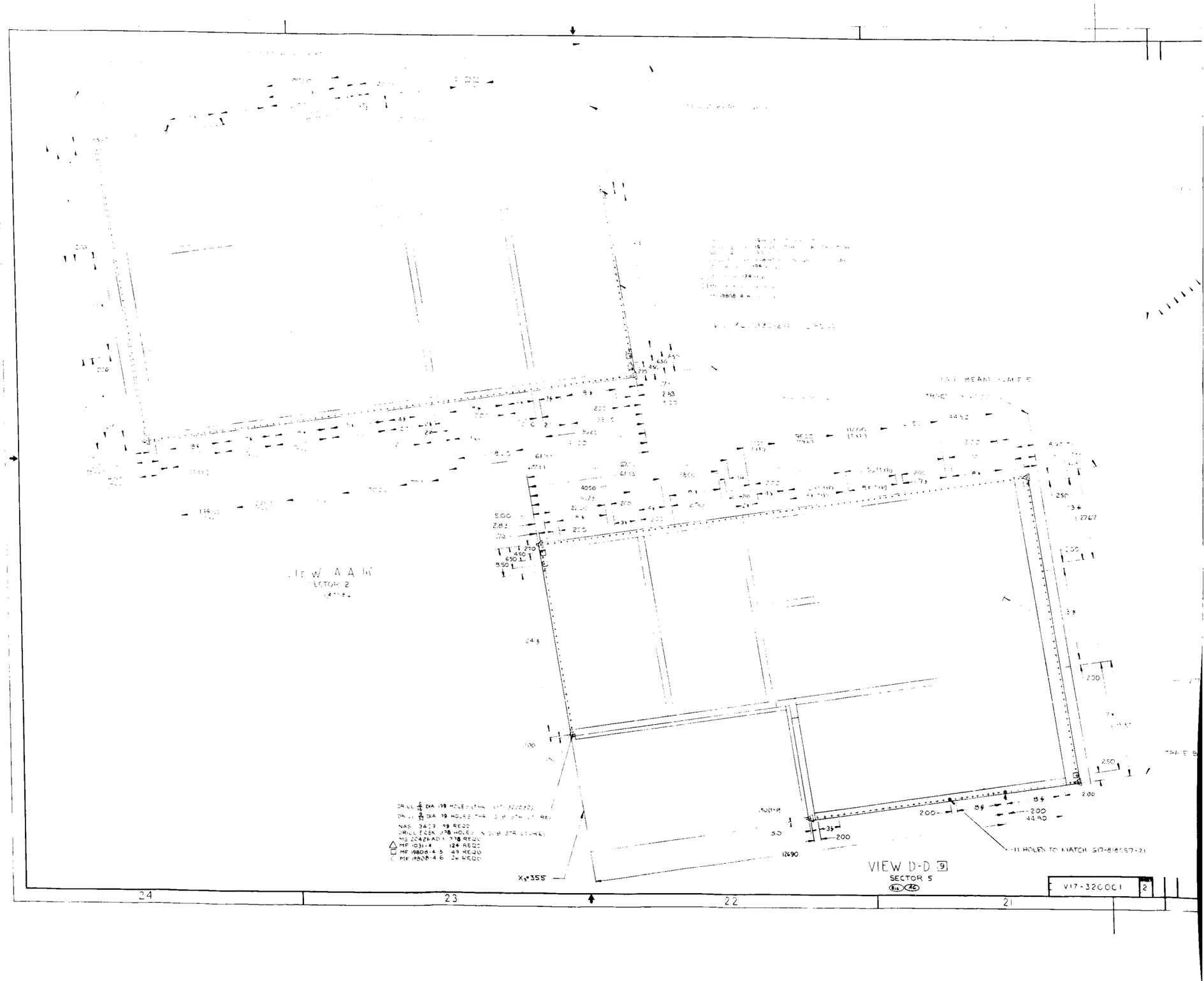
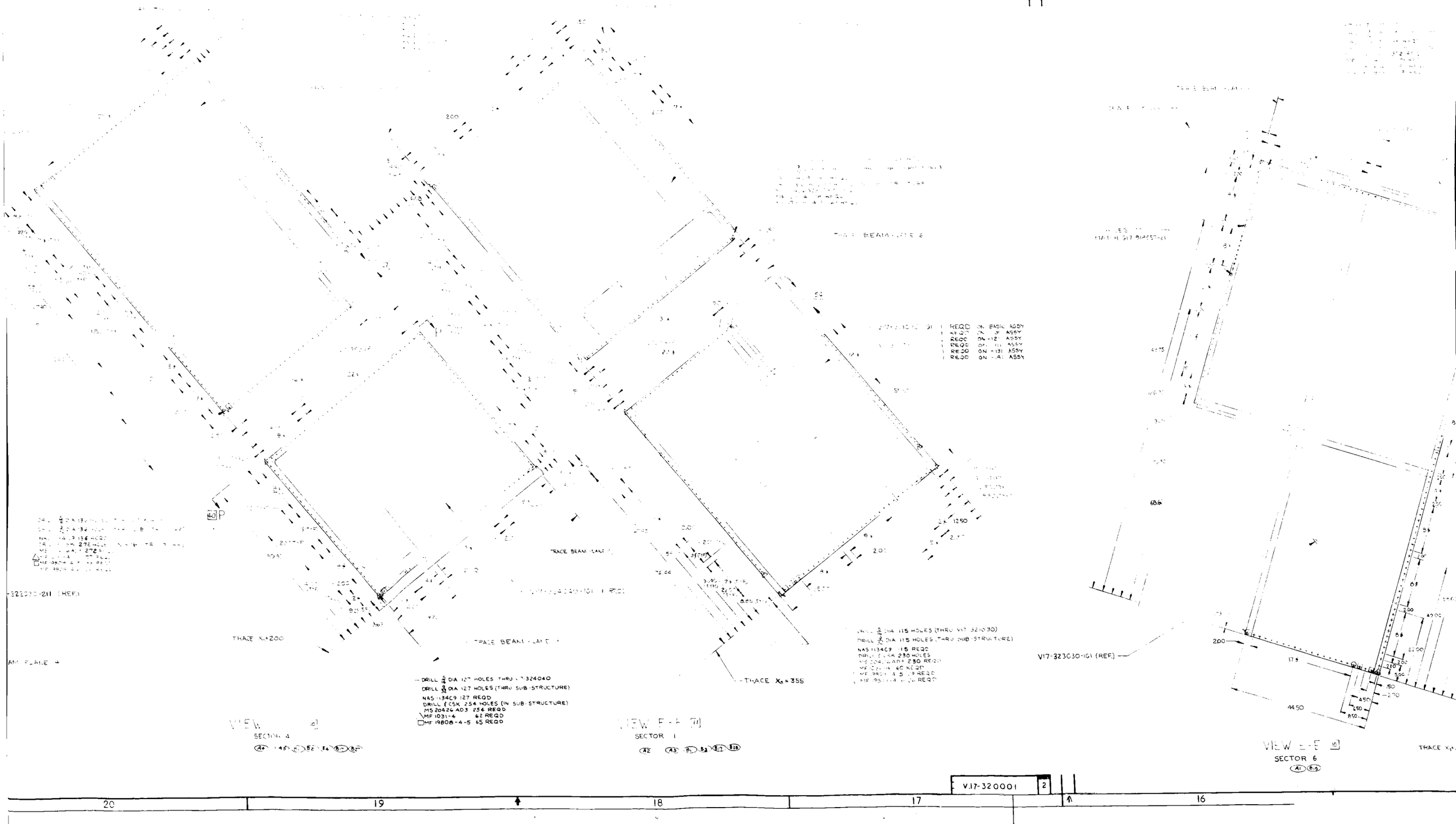


Figure 2-1. Service Module: Structural Assembly (V17-320001-1)

(1)



2


TRACE X=200
TRACE BEAM PLANE 4
TRACE X=355
TRACE BEAM PLANE 5
V17-323030-211 (REF.)
V17-323030-161 (REF.)
DRILL 3/8 DIA 127 HOLES THRU V17-324040
DRILL 3/8 DIA 127 HOLES (THRU SUB-STRUCTURE)
NAS1134C9 127 REQD
DRILL F CSK 254 HOLES (IN SUB-STRUCTURE)
MS20426AD3 254 REQD
MF1031-4 62 REQD
MF1980B-4-5 65 REQD
DRILL 3/8 DIA 115 HOLES (THRU V17-321030)
DRILL 3/8 DIA 115 HOLES (THRU SUB-STRUCTURE)
NAS1134C9 115 REQD
DRILL F CSK 230 HOLES
MS20426AD4 230 REQD
MF1031-4 60 REQD
MF1980B-4-5 59 REQD
VIEW F-F
SECTOR 1
VIEW E-E
SECTOR 6
VIEW P
SECTION A
44.50
17.5
200
686

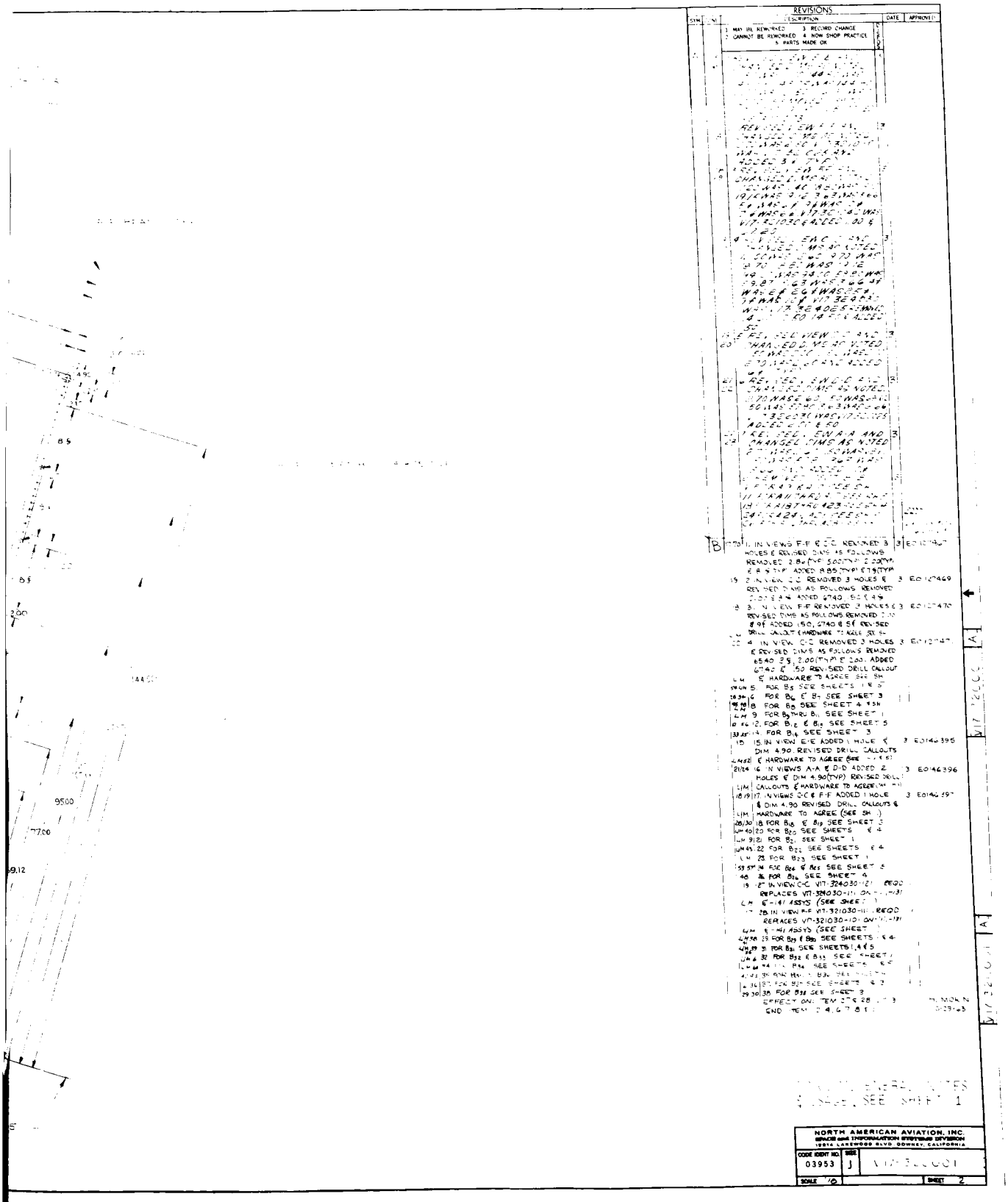
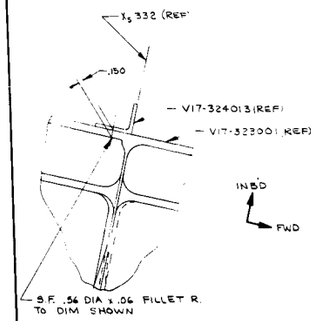
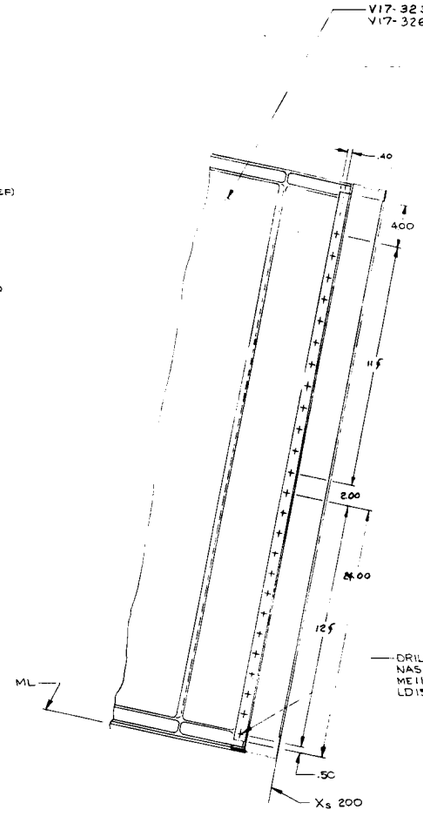


Figure 2-2. Service Module: Structural Assembly (V17-320001-2)

V17-323001-3 1 REQD (BEAM NO. 3)
V17-326001-3 1 REQD (BEAM NO 6)

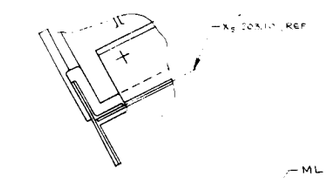


SECT. NN-NN [6] (33)
(THIS VIEW FOR BEAM 3 ONLY)
SCALE 1/1



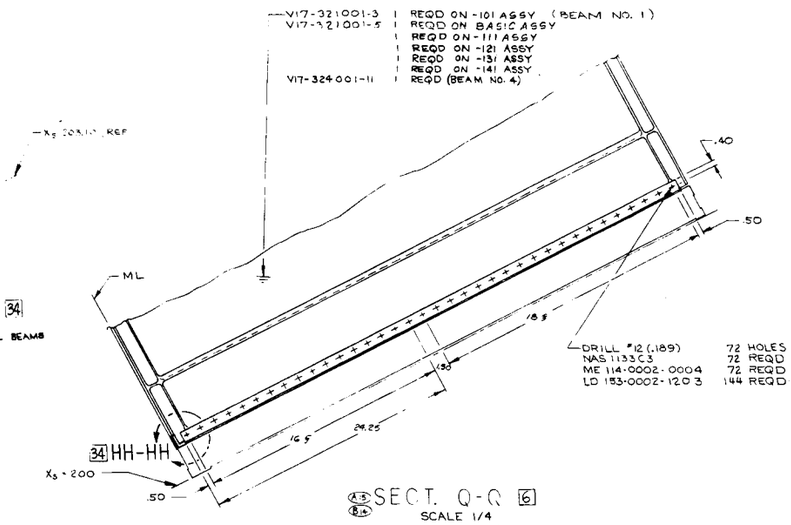
SECT. EE-EE [6]
SCALE 1/4
(A11) (B15)

DRILL #12 (.189) 50 HOLES
NAS1133C3 50 REQD
ME114-0002-0004 50 REQD
LD153-0002-1203 100 REQD



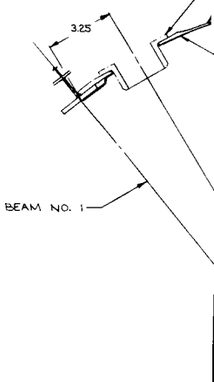
(5a) VIEW HH-HH [34]
SCALE 1/1
THIS VIEW TYP FOR ALL BEAMS

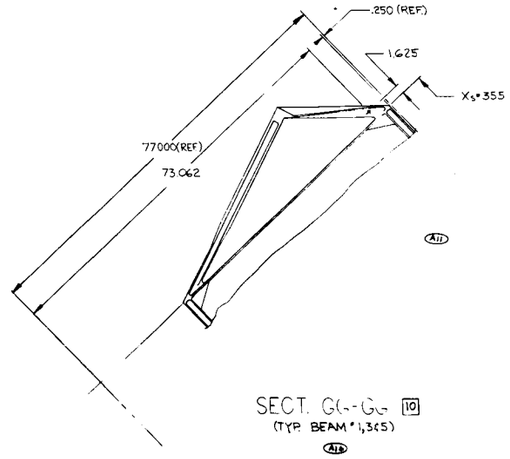
V17-321001-3 1 REQD ON -101 ASSY (BEAM NO. 1)
V17-321001-5 1 REQD ON BASIC ASSY
1 REQD ON -111 ASSY
1 REQD ON -121 ASSY
1 REQD ON -131 ASSY
1 REQD ON -141 ASSY
V17-324001-11 1 REQD (BEAM NO. 4)



DRILL #12 (.189) 72 HOLES
NAS1133C3 72 REQD
ME114-0002-0004 72 REQD
LD153-0002-1203 144 REQD

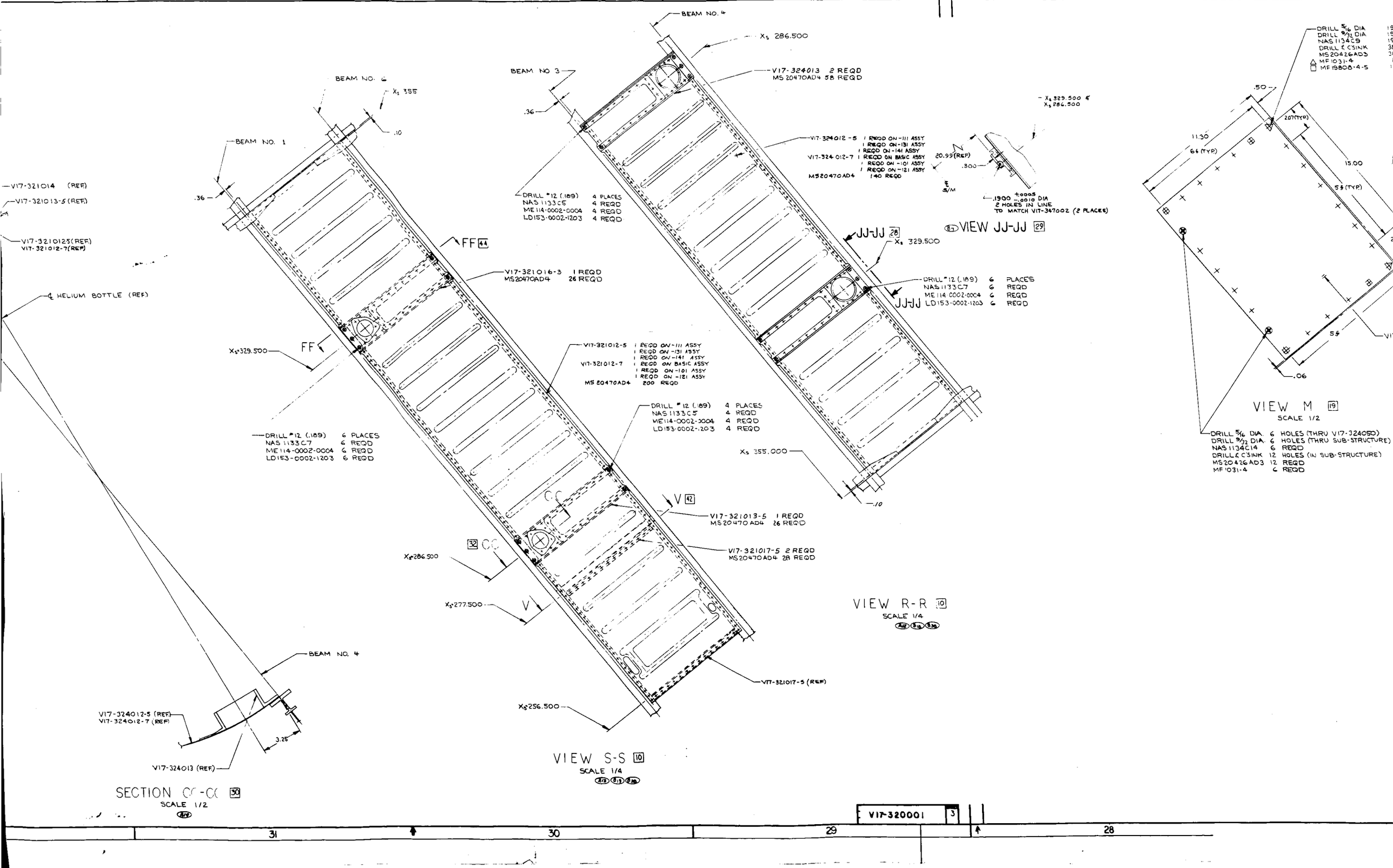
(4.5) (B14) SECT. Q-Q [6]
SCALE 1/4





SECT. GG-GG [10]
(TYP BEAM 1,3&5)
(A12)

2


31
30
29
28
BEAM NO. 4
X_s 286.500
V17-324013 2 REQD
MS 20470AD4 58 REQD
BEAM NO 3
.36
V17-324012-5 1 REQD ON -111 ASSY
1 REQD ON -131 ASSY
1 REQD ON -141 ASSY
V17-324012-7 1 REQD ON BASIC ASSY
1 REQD ON -101 ASSY
1 REQD ON -121 ASSY
MS20470AD4 140 REQD
DRILL #12 (.189) 4 PLACES
NAS 1133C5 4 REQD
ME114-0002-0004 4 REQD
LD153-0002-1203 4 REQD
X_s 329.500 & X_s 286.500
20.99 (REF)
.300
℄ S/M
.1900 +.0005 -.0010 DIA
2 HOLES IN LINE
TO MATCH V17-347002 (2 PLACES)
VIEW JJ-JJ 29
JJ-JJ 28
X_s 329.500
DRILL #12 (.189) 6 PLACES
NAS 1133C7 6 REQD
ME114-0002-0004 6 REQD
LD153-0002-1203 6 REQD
BEAM NO. 6
X_s 355
.10
BEAM NO. 1
.36
V17-321014 (REF)
V17-321013-5 (REF)
V17-321012-5 (REF)
V17-321012-7 (REF)
℄ HELIUM BOTTLE (REF)
FF 44
V17-321016-3 1 REQD
MS20470AD4 26 REQD
X_s 329.500
FF
V17-321012-5 1 REQD ON -111 ASSY
1 REQD ON -131 ASSY
1 REQD ON -141 ASSY
V17-321012-7 1 REQD ON BASIC ASSY
1 REQD ON -101 ASSY
1 REQD ON -121 ASSY
MS 20470AD4 200 REQD
DRILL #12 (.189) 4 PLACES
NAS 1133C5 4 REQD
ME114-0002-0004 4 REQD
LD153-0002-1203 4 REQD
DRILL #12 (.189) 6 PLACES
NAS 1133C7 6 REQD
ME114-0002-0004 6 REQD
LD153-0002-1203 6 REQD
X_s 355.000
.10
V 42
V17-321013-5 1 REQD
MS20470AD4 26 REQD
32 CC
V17-321017-5 2 REQD
MS20470AD4 28 REQD
X_s 286.500
X_s 277.500
V
V17-321017-5 (REF)
X_s 256.500
VIEW S-S 10
SCALE 1/4
VIEW R-R 10
SCALE 1/4
BEAM NO. 4
V17-324012-5 (REF)
V17-324012-7 (REF)
3.25
V17-324013 (REF)
SECTION CC-CC 30
SCALE 1/2
DRILL 5/16 DIA
DRILL 9/32 DIA
NAS1134C9
DRILL & CSINK
MS20426AD3
△ MF1031-4
□ MF19808-4-5
.50
2.07 (TYP)
11.30
6.6 (TYP)
15.00
5.5 (TYP)
.06
VIEW M 19
SCALE 1/2
DRILL 5/16 DIA 6 HOLES (THRU V17-324050)
DRILL 9/32 DIA 6 HOLES (THRU SUB-STRUCTURE)
NAS1134C14 6 REQD
DRILL & CSINK 12 HOLES (IN SUB-STRUCTURE)
MS20426AD3 12 REQD
MF1031-4 6 REQD

HOLES (THRU V17-324050)
HOLES (THRU SUB-STRUCTURE)
REQD
HOLES (IN SUB-STRUCTURE)
REQD
REQD
REQD

TRACE X. 260.370
2 (TYP)
.50
TRACE DATUM PLANE 4
.06

7-324050-21 1 REQD

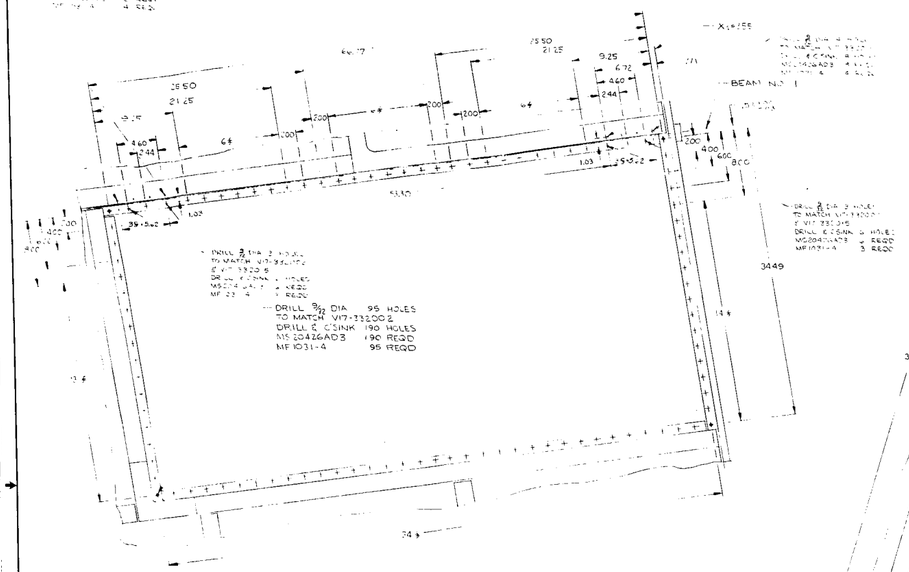
REVISIONS

SYM	ZONE	DESCRIPTION	DATE	APPROVED
		1. MAY BE REWORKED 3. RECORD CHANGE 2. CANNOT BE REWORKED 4. NOW SHOP PRACTICE 5. PARTS MADE OK		
A	13/14 1/12	1. FOR A1 THRU A8 SEE SH 2		
		9. FOR A9 & A10 SEE SH 1		
	34	11. REMOVED V17-321015	3	
	35	1 REQD (V17-32# 015 1 REQD		
	29	12. REVISED VIEW R-R & ADDED RIVET CALLOUT	3	
	30	13. REVISED VIEW S-S & ADDED RIVET CALLOUT	3	
	31	14. COMPLETED SEC CC-CC & ADDED 3.25 DIM.	3	
	33	15. SECT G-G 26 # WAS #0 #	3	
	32	16. ADDED SECT GG-GG,	3	
	36	SECT GG # SECTEE-EE		
	26	17. REMOVED VIEW L & SECT N-N	3	
	37/38	18. FOR A18 THRU A23 SEE SH 4		
	39/40	24. FOR A24 & A25 SEE SH 5		
	1/12	26. FOR A26 THRU A28 SEE SH 1		
B	17-29	1. FOR B_1 THRU B_4 SEE SHEET 2		
	44/45	5. FOR B_5 SEE SHEET 5 & 1		
	34	6. ADDED VIEW HH-HH. (BEAMS HAVE BEEN TRIMMED PER EO 34881)	3	SUPERSEDES E0156939
	28	7. ADDED VIEW JJ-JJ, .1900 +.0005 -.0010 2 HOLES (2 PLCS)	3	E0140147
	45/46	8. FOR B_8 SEE SHEETS 1 & 4		
		9. FOR B_9 THRU B_{11} SEE SHEET 1		
	51/56	12. FOR B_{12} & B_{13} SEE SHEET 5		
	33	14. IN SECT. Q-Q REMOVED 35#. ADDED	3	E0155330
	35	24.25, 1.50, 16# & 18#. IN VIEW EE-EE REMOVED 24# ADDED 24.00, 2.00, .90, 16 # & 18 #		
	1/4 12/13	15. FOR B_{15} SEE SHEETS 1, 2 & 5		
	12/13	16. FOR B_{16} & B_{17} SEE SHEET 1 & 2		
	23	18. IN VIEW R-R MS20470AD4 5B REQD (WAS) 28 REQD	3	
	19/20	19. IN VIEW S-S MS 20470AD4 26 REQD (WAS) 25 REQD (2 PLACES)	3	
	4A 6	20. FOR B_{20} SEE SHEETS 1 & 4		
	1/A 3	21. FOR B_{21} SEE SHEET 1		
	4/A4	22. FOR B_{23} SEE SHEETS 1 & 4		
	1/A	23. FOR $B_{.5}$ SEE SHEET 1		
	53/57	24. FOR B_{24} & B_{25} SEE SHEET 5		
	48	26. FOR B_{26} SEE SHEET 4		
	1/A 11	27. FOR B_{27} & B_{28} SEE SHEETS 1 & 2		
	1/2 28	29. FOR B_{29} & B_{30} SEE SHEETS 1 & 4		
	12 27	31. FOR B_{31} SEE SHEETS 1, 4 & 5		
	1/A 2	32. FOR B_{32} & B_{33} SEE SHEET 1		
	1/A 14	34. FOR B_{34} SEE SHEETS 1 & 5		
	42/43	35. FOR B_{35} & B_{36} SEE SHEET 4		
	36 6	37. ADDED SECTION NN-NN & S.F. NOTE. (SEE SHEET 1)	3	E0118128
	29 30	38. IN VIEW R-R MS20470AD4 140 REQD (WAS) 142. IN VIEW S-S MS20470AD4 200 REQD (WAS) 202	3	H. MORIN 10-29-63

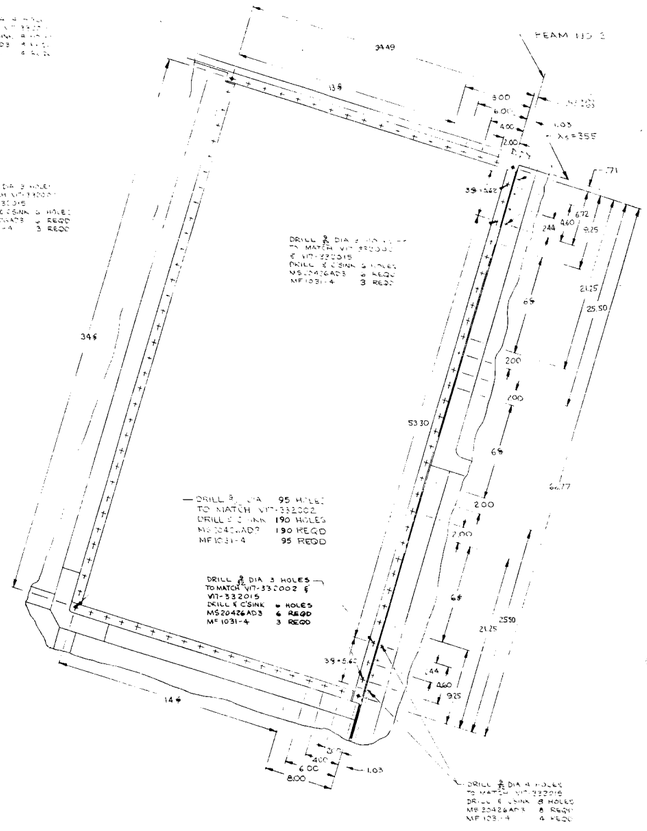
FOR L/M, GENERAL NOTES & USAGE, SEE SHEET 1

NORTH AMERICAN AVIATION, INC. SPACE and INFORMATION SYSTEMS DIVISION 12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA		
CODE IDENT NO. 03953	SIZE J	V17-320001
SCALE NONE		SHEET 3

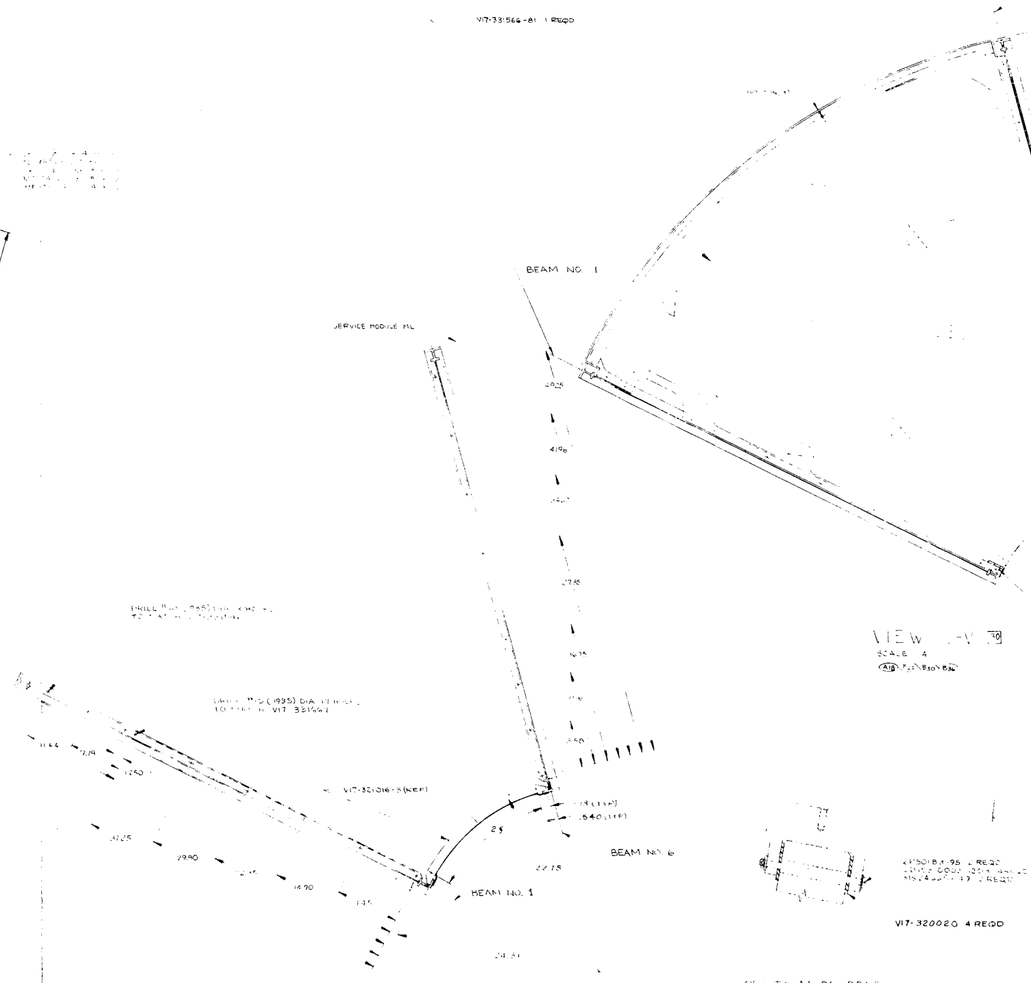
Figure 2-3. Service Module: Structural Assembly (V17-320001-3)



VIEW BB [23]
(TYP FOR SECTOR 2 & SECTOR 5)
SCALE 1/4



VIEW AA [51]
(TYP FOR SECTOR 3 & SECTOR 6)
SCALE 1/4



SECTION FF-FF [30]
(TYP FOR STA 456.50 & 332.00
SCALE 1/4

SECTION DD-DD [16]
SCALE 1/1

VI7-320020 4 REQD

VI7-320001 4

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION

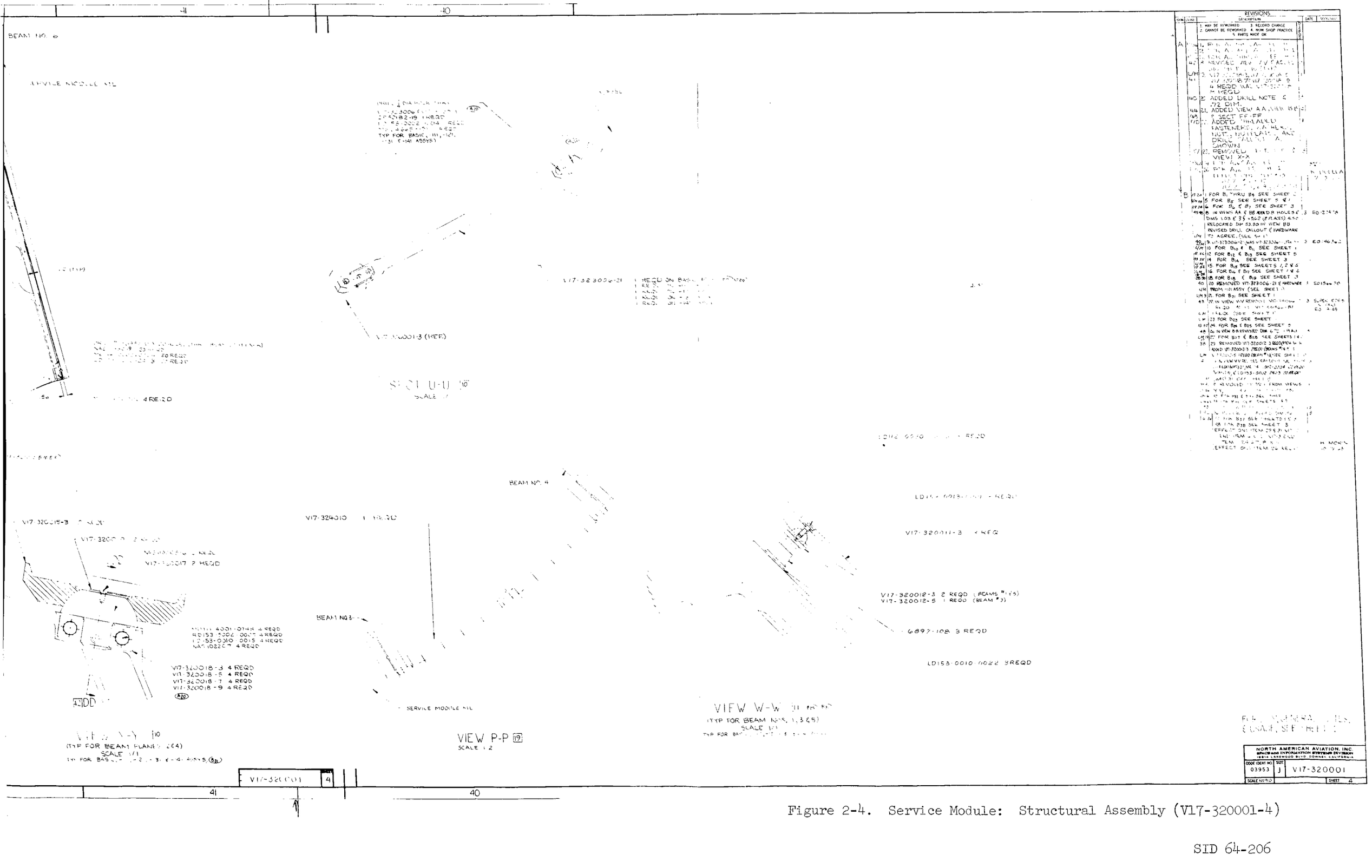
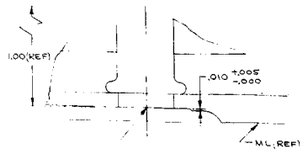
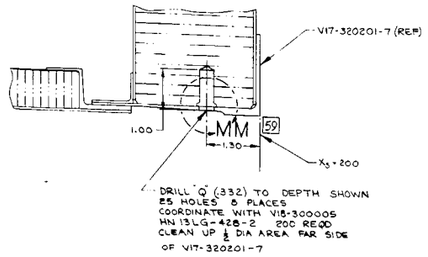


Figure 2-4. Service Module: Structural Assembly (V17-320001-4)

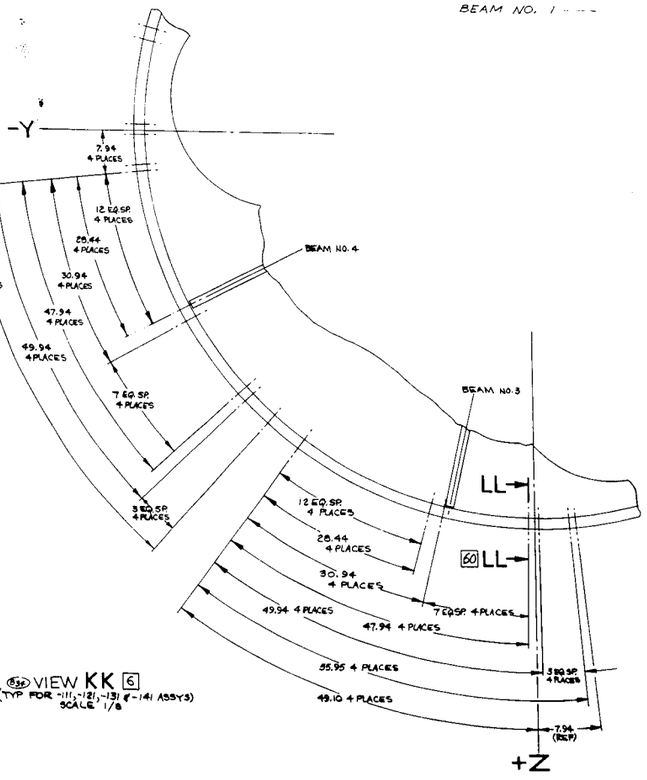


SF .56 DIA .031 FILLET R
X DEPTH SHOWN
NOTE: CL OF SPOT FACE MUST
BE PERPENDICULAR TO ML

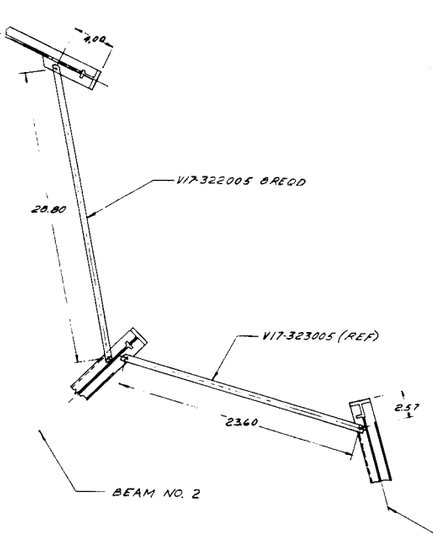
VIEW MM [60] (B28)
(TYP FOR -111, -121, -131, & -141 ASSYS)
SCALE 4/1



(B34) SECTION LL-LL [59]
(TYP FOR -111, -121, -131 & -141 ASSYS)
SCALE 1/1



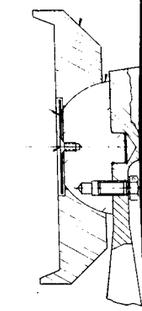
(B32) VIEW KK [6]
(TYP FOR -111, -121, -131 & -141 ASSYS)
SCALE 1/8



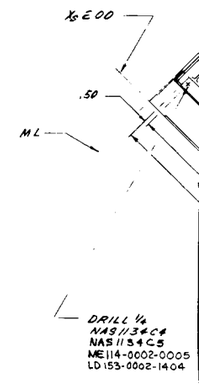
SECT T-T [8]
(TYP FOR S/M STATIONS
277, 296, 314, 1332)
SCALE 1/4
(B22) (B24)

V17-320019 1 REQD

NAS1102C3-6 1 REQD



VIEW X-
(FOR BEAM PLANE
(TYP FOR BASIC, -111, -121, -
SCALE 1-
(A22)



55 | 54 | 53 | 52 | 51

-320015-3 1 REQD

V17-320016 1 REQD

V17-323006-21 (REF)

NAS1005-4.0A 1 REQD
LD153-0010-0011 2 REQD
ME114-0002-0006 1 REQD

NAS1005-2W 2 REQD.
LD153-0010-0011 2 REQD
INSTALL WITH MS20995N51 WIRE

X [10]
6 ONLY)
51 E-141 ASSYS) [27]

TRACE X=278

.50
2.50 (TYP)
2.50 (TYP)
20.50
8 f
4 f
20.50
9.00
2.00
2.50
2.50 (REF)
.06
.50
.06
9 f
11 f
BEAM NO. 6

DRILL 5/16 DIA 9 HOLES (THRU V17-321050)
DRILL 9/32 DIA 9 HOLES (THRU SUB-STRUCTURE)
NAS 1134C4 9 REQD
DRILL & C'SINK 18 HOLES (IN SUB-STRUCTURE)
MS 20426AD3 18 REQD
MF 1031-4 9 REQD

DRILL 5/16 DIA 29 HOLES (THRU V17-321050)
DRILL 9/32 DIA 29 HOLES (THRU SUB-STRUCTURE)
NAS 1134C9 29 REQD
DRILL & C'SINK 58 HOLES (IN SUB-STRUCTURE)
△ MF 1031-4 8 REQD
□ MF 19808-4-5 21 REQD
MS20426AD3 58 REQD

V17-321050-31 1 REQD

VIEW L [17]
SCALE 1/2
(A27) (B5) (B6)

11 HOLES TO MATCH G17-818057-11

DRILL 7/32 DIA 186 HOLES (THRU V17-323030)
DRILL 1/4 DIA 186 HOLES (THRU SUB-STRUCTURE)
NAS1134C9 186 REQD
DRILL 1/4 CSK 372 HOLES (IN SUB-STRUCTURE)
MS20426AD3 372 REQD
△ MF 1031-4 126 REQD
□ MF 19808-4-5 45 REQD
⬡ MF 19808-4-6 15 REQD

BEAM NO. 2

TRACE X=355

V17-323030-101 2 REQD

A A [46]

68.62
77.00
95.00
4 f
112.00 (REF)
2.00
8 f
155.00 (REF)
2.00
8 f

11 HOLES TO

TRACE X=200

VIEW B-B [11]
SECTOR III
(A24) (B12) (B16)
NOTE: HOLE LOCATIONS ARE THE SAME AS IN VIEW E-E (ZONE 16) EXCEPT AS NOTED

NAS1134C5 14 PLACES

V17-322001-3 1 REQD
V17-325001-3 1 REQD

24.00
2.00
13 f
.50
.50

54 HOLES
40 REQD
14 REQD
54 REQD
54 REQD

SECT N-N [6]
SCALE 1/4
(A27) (B13)

V17-320001 [5]

55 | 54 | 53 | 52 | 51

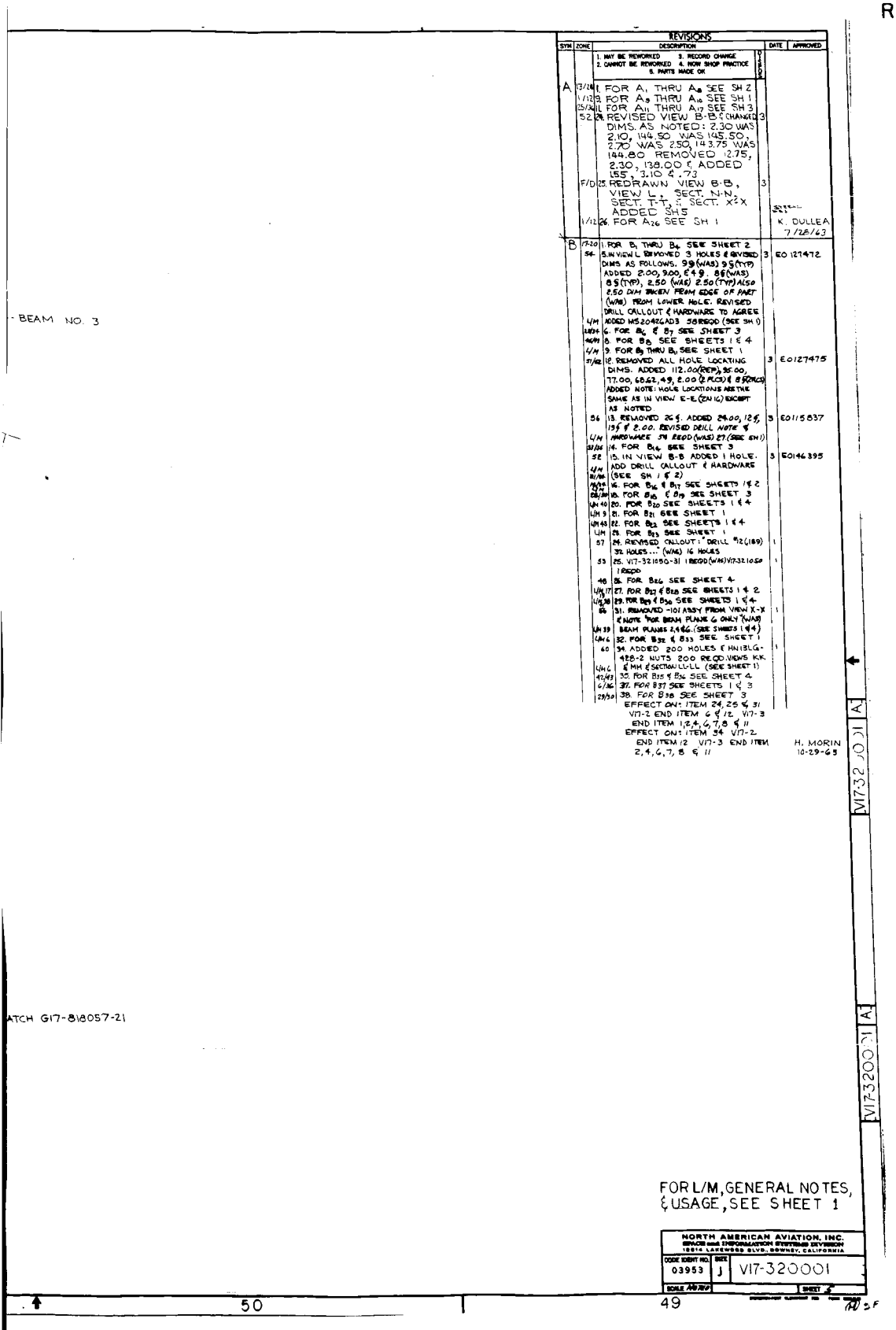
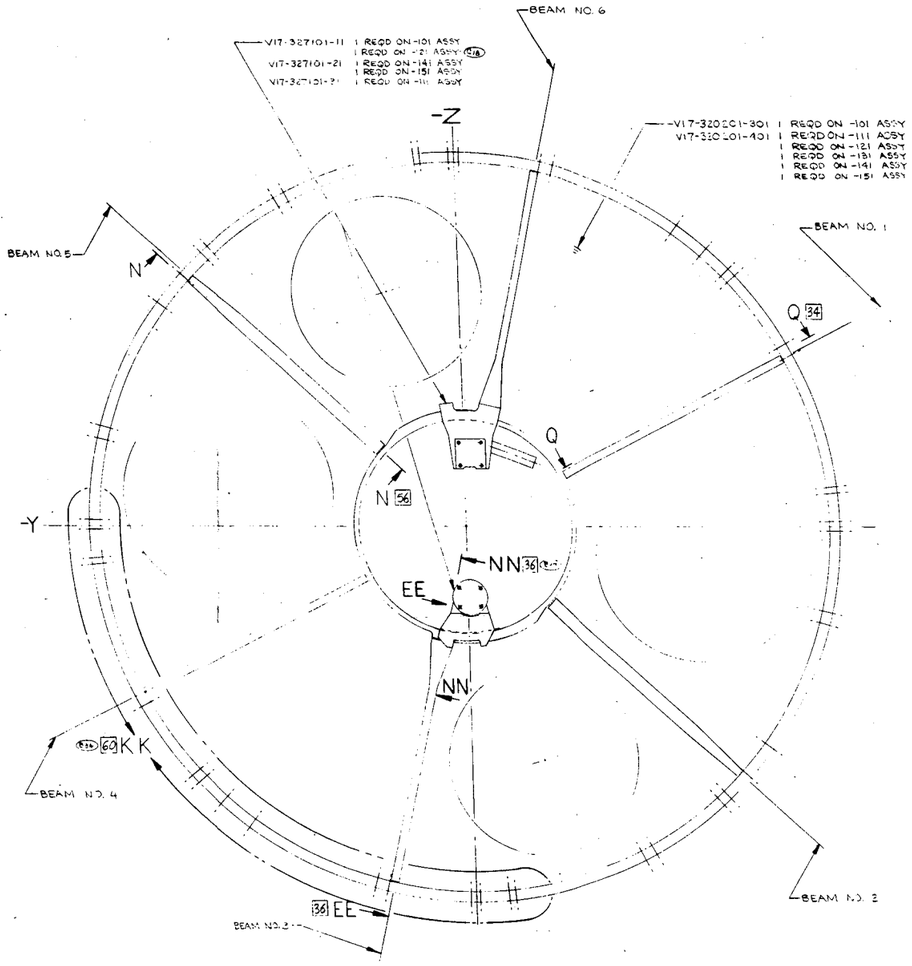


Figure 2-5. Service Module: Structural Assembly (V17-320001-5)

V17-320001

V17-320001 63

72 71 70 69 68 67 66

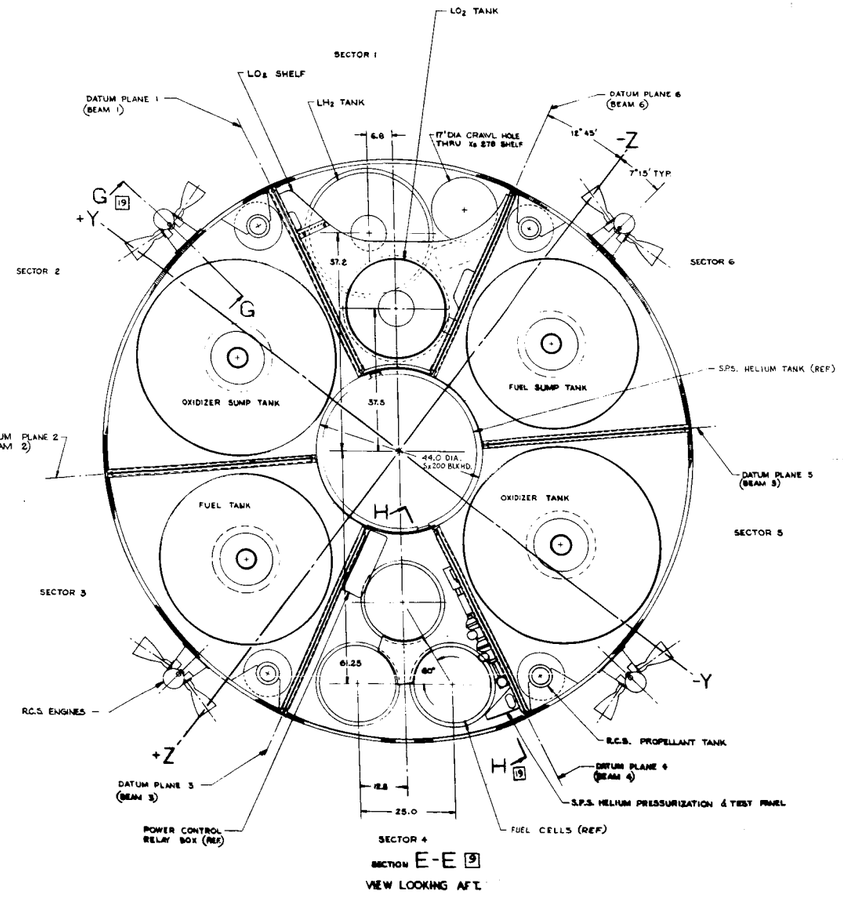


VIEW UU-UU 7

SCALE 1/8

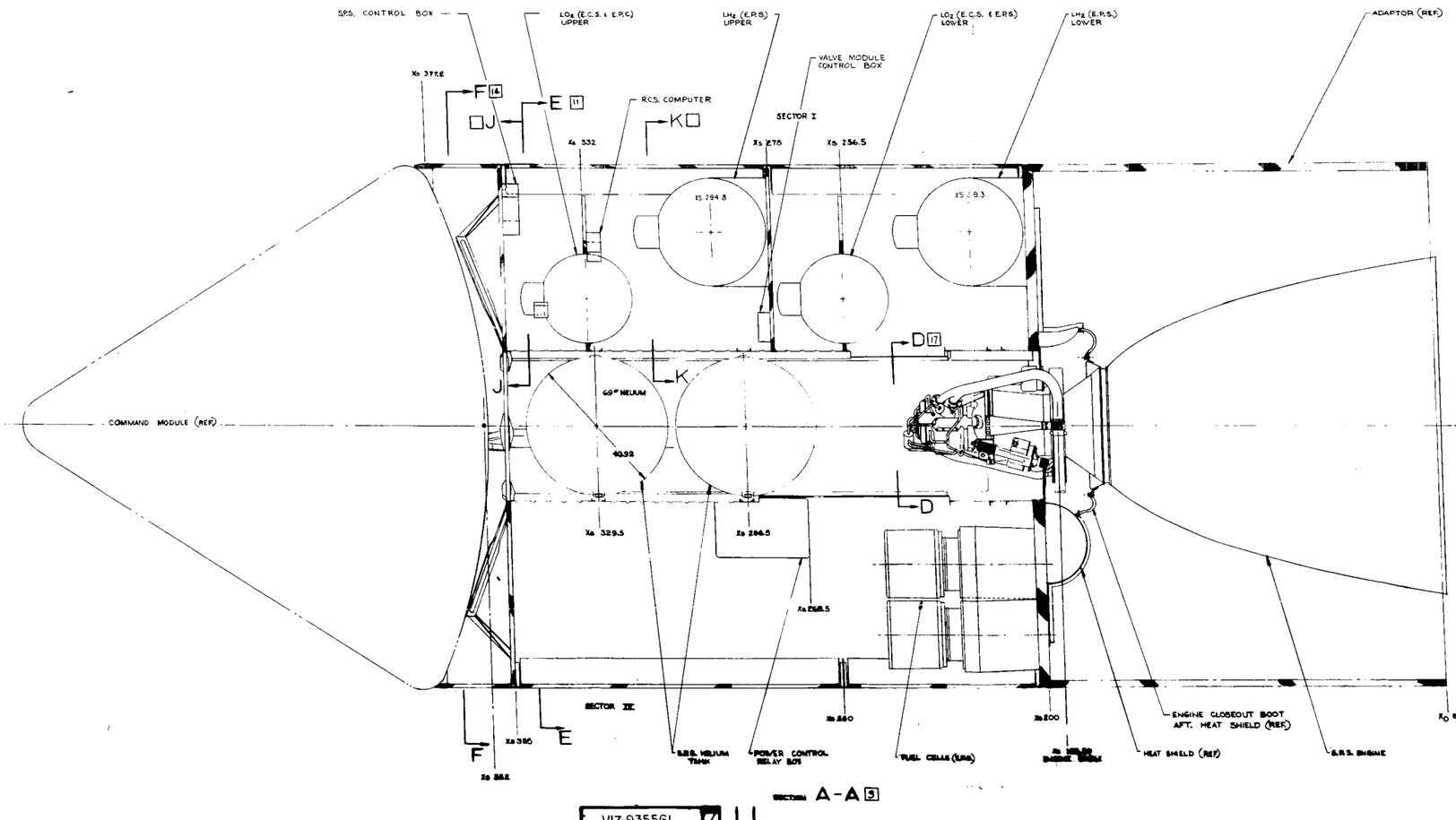
REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVED
		1. MAY BE REWORKED 2. RECORD CHANGE 2. CANNOT BE REWORKED 4. NON SHOP PRACTICE 5. PARTS MADE OR		
C	L/M	1 FOR C1 SEE SHEET 1		
	P/R	2 FOR C2 SEE SHEET 4		
	M-N	3 FOR C3 SEE SHEETS 1,2,3,4		
	L-M, L	4 FOR C4 SEE SHEETS 1,3,4		
	M-N	5 FOR C5 SEE SHEETS 1,2,3		
	L-M, P-R	6 FOR C6 SEE SHEETS 1,2,3		
	M-N	7 FOR C7 SEE SHEETS 1,2,3		
	16	8 FOR C8 SEE SHEET 8		
	8	9 FOR C9 SEE SHEET 1		
	60	10 FOR C10 SEE SHEET 4		
	28	11 FOR C11 SEE SHEET 3		
	17/20	12 FOR C12 SEE SHEET 2		
	27/36	13 FOR C13 SEE SHEET 5		
	39/51	14 FOR C14 SEE SHEET 5		
	49/61	17 (ADDED SHEET 6) REMOVED VIEW LOOKING AFT & ADDED SQUARE FROM SHEET 1 & ADDED AS VIEW 7 ON TO SHEET 6 (SH 2)	3	
	65	18 V17-320001-111 REQD ON -101 ASSY 2 (NA) 1 V17-327101-31 REQD ON -121 ASSY SEE SHEET 1		
	L-M			
	L-M	19 FOR C9 SEE SHEET 1		
	M-N	20 FOR C8 SEE SHEETS 1,2,3,5		
	P-R	21 FOR C1 SEE SHEET 1		
	L/M	22 FOR C1 SEE SHEET 1		
	14/15	25 FOR C1 SEE SHEET 2 & 3		

Figure 2-6. Service Module: Structural Assembly (V17-320001-6)



SECTION E-E 9

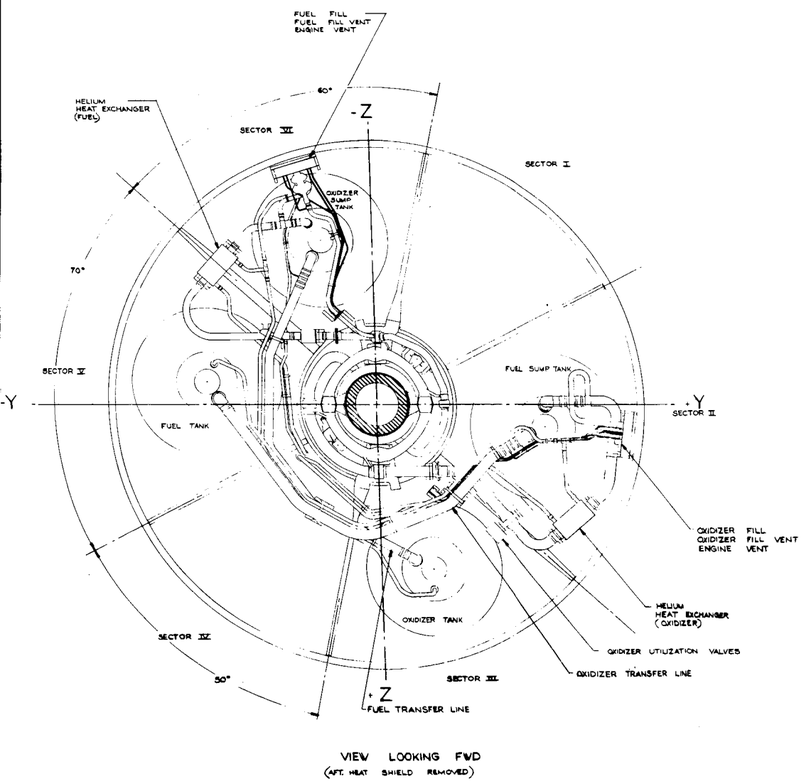
VIEW LOOKING AFT



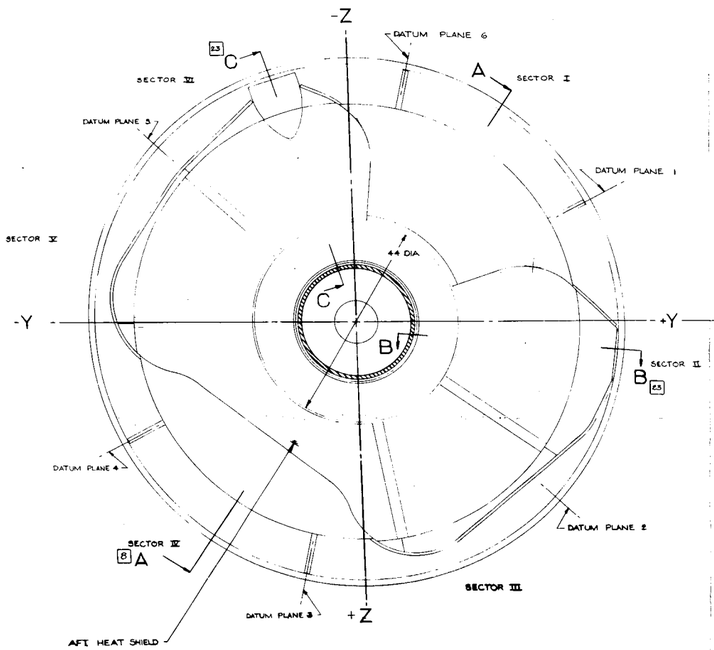
SECTION A-A 5

V17-935561

12 11 10 9 8 7



VIEW LOOKING FWD
(AFT. HEAT SHIELD REMOVED)



VIEW LOOKING FWD

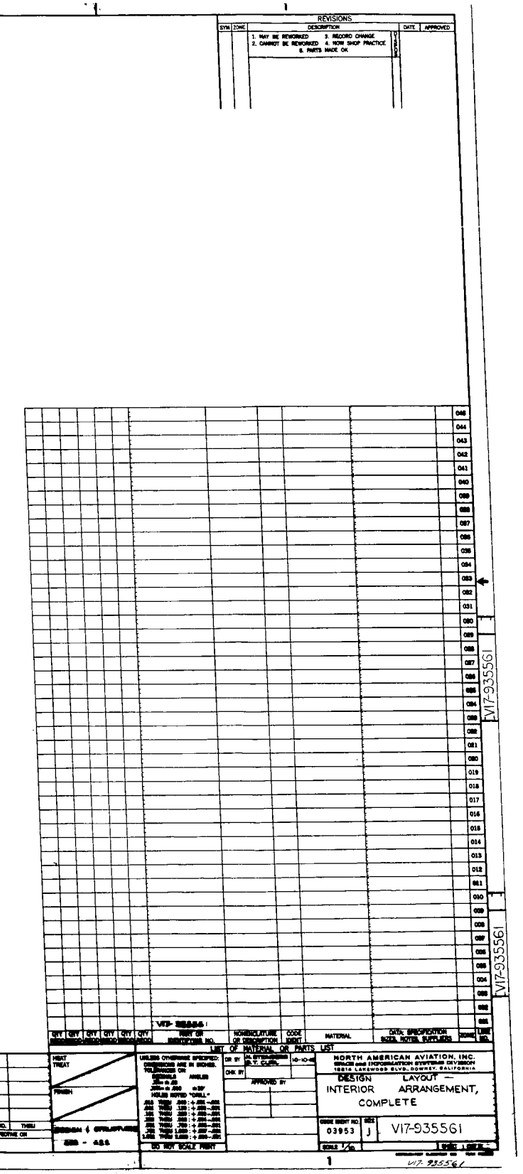
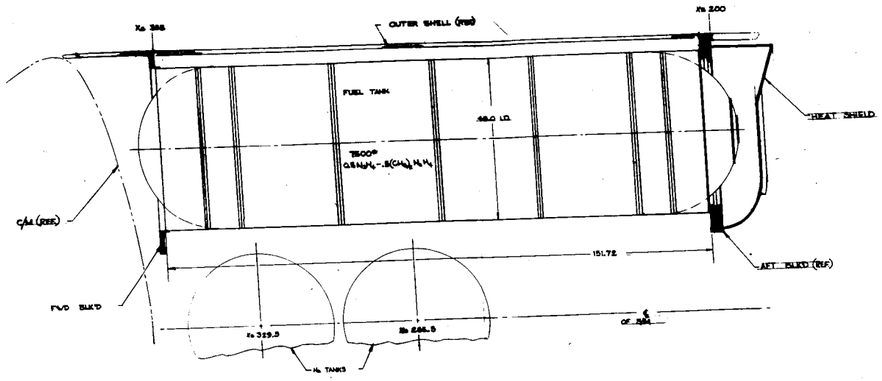
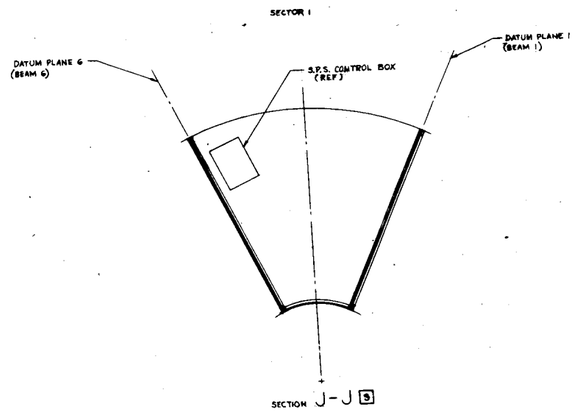


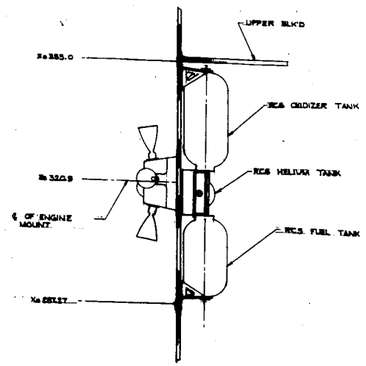
Figure 2-7. Complete Interior Arrangement of Service Module (V17-935561-1)



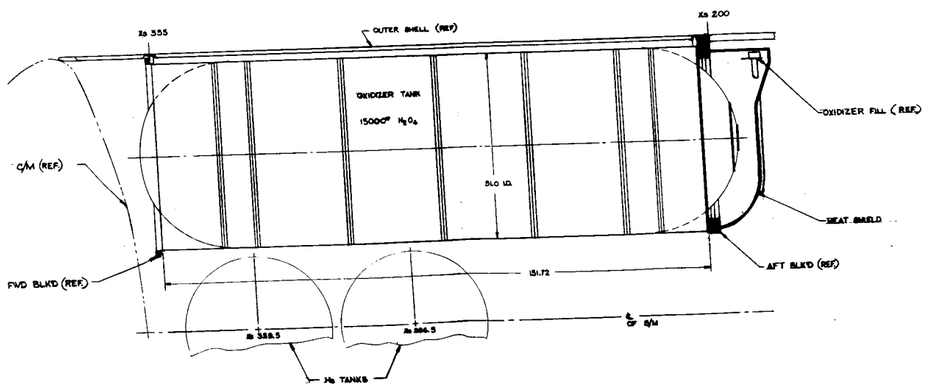
SECTION C-C [4]
FUEL TANK
ROTATED C



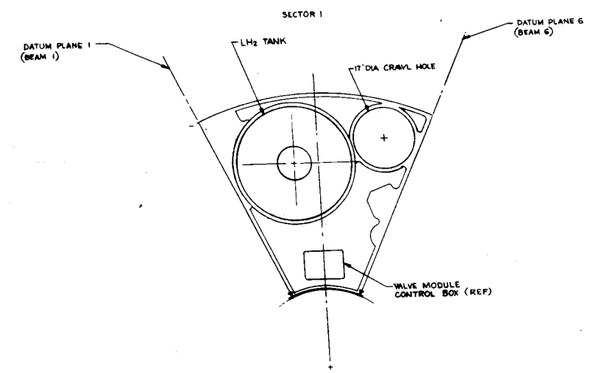
SECTION J-J [9]



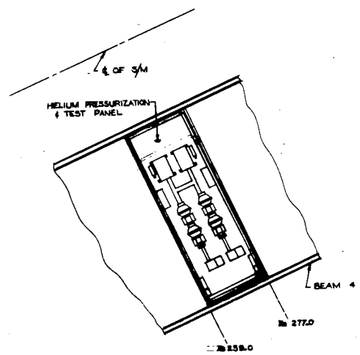
SECTION G-G [12]
ROTATED
SHOWING R.C.S. MODULAR UNIT



SECTION B-B [2]
OXIDIZER TANK
ROTATED C



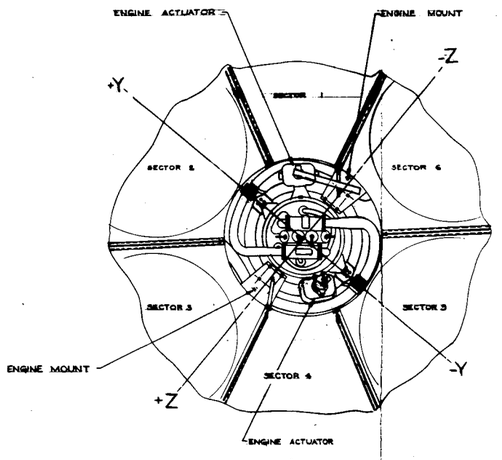
SECTION K-K [9]



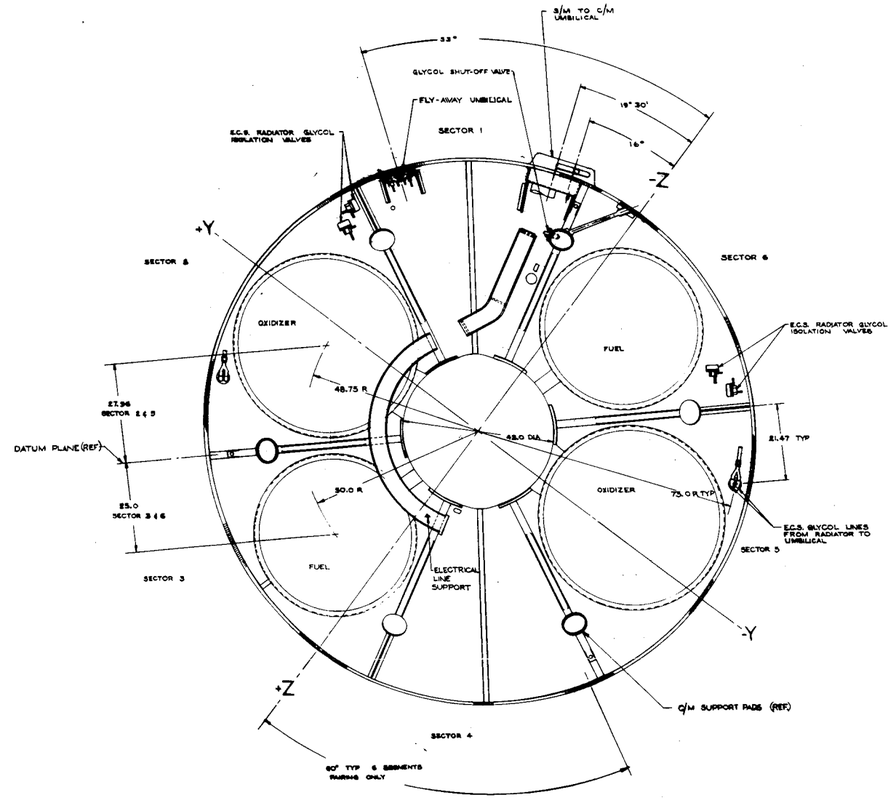
SECTION H-H [11]

V17-935561 [2]

24 23 22 21 20 19



SECTION: D-D [6]
VIEW LOOKING AFT.



SECTION F-F [5] X_B 395 BLR'D
VIEW LOOKING AFT

Figure 2-8. Complete Interior Arrangement of Service Module (V17-935561-2)

2.2.3 Panels which form the center shell or web are made of aluminum sheet 0.016 inch in thickness. The web structures are found only along the center lengths of Sectors One, Four, Six and Three. (See drawings V17-935561, Figures 2-7 through 2-8, and V17-320001, Figures 2-1 through 2-6.)

2.2.4 The function of the center webs is twofold: a) to aid as stabilizers for the six radial beams; b) to distribute the weight of the helium bottles and the engine mounts which are located in Sectors One, Four, Six and Three.

2.2.5 The aft bulkhead is made of bonded aluminum honeycomb sandwich three inches thick and 154 inches in diameter. The center opening coincides with the inner caps of the vertical beams and is 44 inches in diameter. The forward bulkhead is made of the same type of material, has the same size of center opening, but is only one inch thick. See drawing V17-320101 (Figure 2-9) for the forward bulkhead, and drawing V17-320201 (Figures 2-10 through 2-13) for the aft bulkhead.

2.2.6 Both bulkheads distribute the radial beams' loading into the outer shell. The aft bulkhead per se acts as support structure for the SPS main tanks, the SPS engine and gimbal mount, the radial beams, the EPS fuel cells, the cryogenic hydrogen tank, the aft heat shield, the high-gain antenna, hard lines, electrical wiring, etc. The aft bulkhead also serves as a heat barrier between the SPS engine and the S/M interior. The forward bulkhead provides lateral support for the upper ends of the SPS main tanks.

2.2.7 All radial beams have similar configurations. Each beam is a rectangular structure machined and chem-milled from 2.5-inch aluminum-plate stock. Each has a minimum web .018-inch thick and stiffeners .06-inch thick. The vertical distances between stiffeners vary between 6 and 19 inches. For a typical beam configuration, see drawing V17-320001, "Assembly of Radial Beam 2" (Figure 2-14).

2.2.8 Criteria which governed the choice of radial beam configuration were: a) the length of the main SPS tanks in their final configuration; b) accessibility to these tanks; c) weight and fabrication savings through the use of numerically controlled machining and chem-milling instead of the use of more conventional methods including welding of structures.

12 | 11 | 10 | 9 | 8

V17-323020-11 (REF)
V17-323020-81 (REF)
V17-320103-3 (REF)
.46
4 REQ'D
7.50 TRUE (TYP)
6.00 (TYP)
3 EQ SP TRUE (TYP)
8.00 (TYP)
1.50 TRUE (TYP)
V17-321020-51 (REF)
.50
.50
MS91-6-3 48 REQ'D
V17-320111 (REF)

VIEW D-D [8]
(TYP 6 PLACES)

.38
80 REQ'D [1]
39 EQ SP
39.75 (REF)
.32
.38
.32

DETAIL N [6] (TYP 6 PLACES)

V17-326001 (REF)
V17-320108-2 (REF)
R, 355 (REF)
FWD
V17-320103-3 (REF)
V17-320111 (REF)

SECTION R-R [12]
SCALE 1/4

V17-320108 (REF)
.50 (REF)
V17-320108 (REF)
P200A-2 (REF)
V17-323020-11 (REF)

SECTION L-L [16]
SCALE 1-1

V17-320104-11 (REF)
.50 (REF)
V17-321020-81 (REF)
P200A-2 (REF)
V17-320102 (REF)
P200A-4 (REF)
V17-323020-81 (REF)

SECTION U-U [10]
SCALE 1-1
(A1a) -101 ASSY

VARIES AS SHOWN
SEE DETAIL A-A
ZONE [5]
.50
.50 R
22.00 R
¼ 355
V17-320105 (REF)
V17-320102 (REF)

SECTION E-E [7]
(TYP 2 PLACES)
SCALE 1-1

V17-325001 (REF)
V17-322020-51 (REF)
V17-322020-61 (REF)
804 (REF)
V17-320102 (REF)
P200A-4 36 REQ'D
LOCATE FROM V17-322020-51 AND V17-323020-11
BASIC ASSY
P200A-2 16 REQ'D (A1a)
P200A-4 16 REQ'D
LOCATE FROM V17-322020-61 & V17-323020-81
-101 ASSY (A1a)

U [10] & L [11]

DETAIL M [6] (TYP 2 PLACES)
SCALE 1-1

L & U
.38
V17-320104 2 REQ'D (BASIC ASSY) (A1a)
V17-320104-11 2 REQ'D (-101 ASSY) (A1a)

(BASIC ASSY) V17-323020-81 2 REQ'D (A1a)
(-101 ASSY) V17-323020-81 2 REQ'D

SEE DETAIL S [3]
-Z
V17-326001 (REF)
12 D
D
11 F
SEE DETAIL B [12]
SEE DETAIL K [11]
60°
50°
(A1a) V17-321020-81 1 REQ'D

V17-321020-51 (REF)
10 REQ'D
V17-320103-3 (REF)
V17-320108-3 (REF)
.38 (REF)
V17-320111 4 REQ'D
V17-323020-11 (REF)
V17-323020-81 (REF)
V17-320103-3 (REF)
8.00 (TYP)
3 EQ SP TRUE (TYP)
6.00 TRUE (TYP)
3.00 TRUE (TYP)
4.00 TRUE (TYP)
4.00 TRUE (TYP)
.38 (TYP)
V17-320107 (REF)

DETAIL B [12]
SCALE 1-1
(TYP 6 PLACES)

VIEW F-F [9]
SCALE 1-1
6 PLACES

V17-320107 (REF)
V17-320103-3 2 REQ'D
.82 (REF)
.82 6 REQ'D (A1)
V17-321020-81 (REF)
.49 (TYP)
.38 (TYP)
.06 .85 (TYP)
39.25 (REF) (A1a)
30 (REF) (A1a)
V17-320107 (REF)

DETAIL K [11]
SCALE 1-1
8 PLACES

V17-320107 2 REQ'D
¼ 355
V17-320103-3 CAP (REF)
.85 (REF)
.06 (REF)
V17-321020-81 1 REQ'D (A1a)

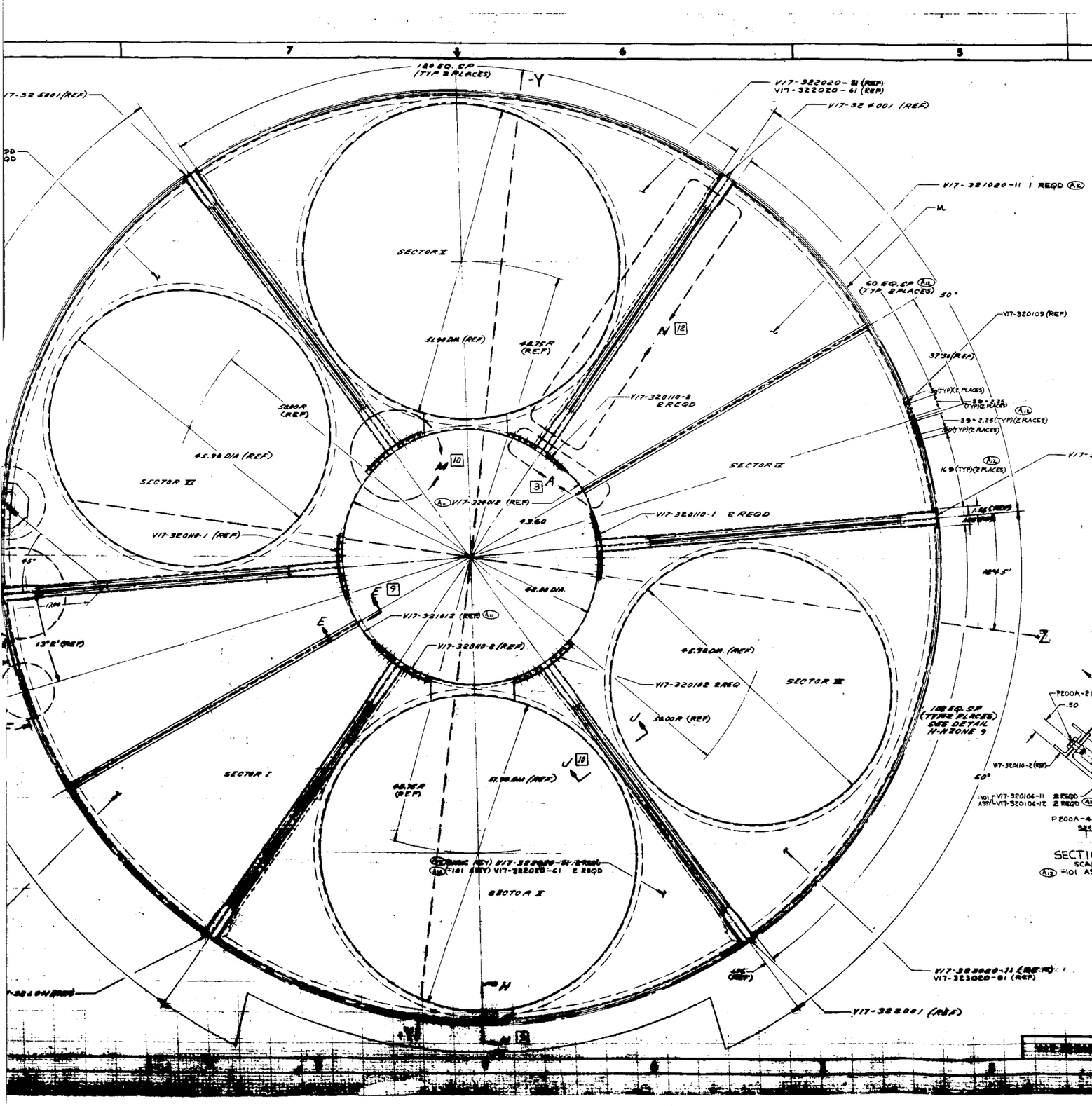
SECTION P-P [18]
SCALE 1/4

SECTION H-H [4]
SCALE 1/4

SECTION J-J [6]
(TYP 6 PLACES)
SCALE 1-1

.25 TYP (6 PLACES)
.12
V17-323020-81 (REF)
V17-322020-81 (REF)
V17-322001 (REF)
E BEAM NO. 2 (REF)
V17-322020-51 (REF)
V17-322020-61 (REF)

2


SECTOR II
SECTOR III
SECTOR I
SECTOR IV
SECTOR V
SECTOR VI
V17-322020-51 (REF)
V17-322020-61 (REF)
V17-324001 (REF)
V17-321020-11 1 REQD
V17-320109 (REF)
V17-320110-8 2 REQD
V17-323001 (REF)
V17-320110-1 2 REQD
V17-324012 (REF)
V17-320118-8 (REF)
V17-320182 2 REQD
V17-320118-1 (REF)
V17-322001 (REF)
V17-323020-11 (REF)
V17-323020-61 (REF)
V17-322001 (REF)
60 EQ. SP (TYP 8 PLACES) 50°
180 EQ. SP (TYP 8 PLACES)
45.98 DIA (REF)
42.75 R (REF)
50.00 R (REF)
43.60 R (REF)
43.60 DIA.
43.98 DIA. (REF)
37.36 (REF)
13°2' (REF)
45°
1.66 (REF)
184.51
1.200
(-101 ASSY) V17-322020-61 2 REQD
(-101 ASSY) V17-320106-11 2 REQD
(-101 ASSY) V17-320106-12 2 REQD
P200A-4 (REF)
34 REQD
(-101 ASSY)
SECTION T-T 5
SCALE 1-1
A12 -101 ASSY
TRACEABILITY SYMBOLS
E TRACEABILITY NOT REQUIRED
S TRACEABILITY BY SERIAL NUMBER (MA0101-0206 thru MA0101-0209)
T TRACEABILITY BY LOT NUMBER
V17-322020-51 (REF)
V17-322020-61 (REF)
V17-320106-2 (REF) (BASIC ASSY)
V17-320106-12 (REF) (-101 ASSY)
V17-323001 (REF)
1.06 (TYP) 12 PLACES
P200A-2 32 REQD
P200A-4 32 REQD
FOR V17-320106-12 & V17-320110
LOCATE FROM V17-321020-11 OR V17-321020-61
FOR V17-320106-11 & V17-320110
LOCATE FROM V17-321020-11 OR V17-321020-51
V17-320110-2 (REF)
8J 5 4 REQD
A7
20 (TYP)
V17-320105 (REF)
16 EQ. SP.
P200A-2 56 REQD
FOR V17-320106-2 & V17-320110
LOCATE FROM V17-321020-11 OR V17-321020-51 &
V17-322020-51, FOR V17-320106-1 &
V17-320118-1 LOCATE FROM V17-321020-11 OR
V17-321020-51 & V17-323020-11
BASIC ASSY
DETAIL A 2
(SHOWN 6 OPPOSITE TYP 2 PLACES)
SCALE 1-1
FWD
X5 355
1.122 (REF)
.50
V17-321020-11 (REF)
V17-321020-51 (REF)
OPPOSITE TO RIVET ON ANGLE LEG
MS20600AD5W2 34 REQD
INSTALL PER MA0101-006
AS SHOWN IN VIEW G-G ZONE 2
V17-320105 1 REQD (2 PLACES)
44
V17-324012 (REF)
V17-320118-2 (REF)
BASIC ASSY V17-320106-1 2 REQD
V17-320106-2 2 REQD
A6 P200A-2 (REF.)
A7 8J 4 34 REQD
SECTION C-C 5
SCALE 1/1
BASIC ASSY
22.69 R.
V17-320103 (REF.)
4 REQD
NAS 1132CS 4 REQD
AN6 10-3002-0006 4 REQD
LDISS-0002-0003 4 REQD
DETAIL S 2
SCALE 1-1 A6
8 SYMBOL ⊕ DENOTES EQUAL SPACES
T MAY BE PURCHASED FROM THE NATIONAL SCREW & MFG CO.
OR ANGLES EQUIVALENT
FOR MA0101-006
RIVET CO.

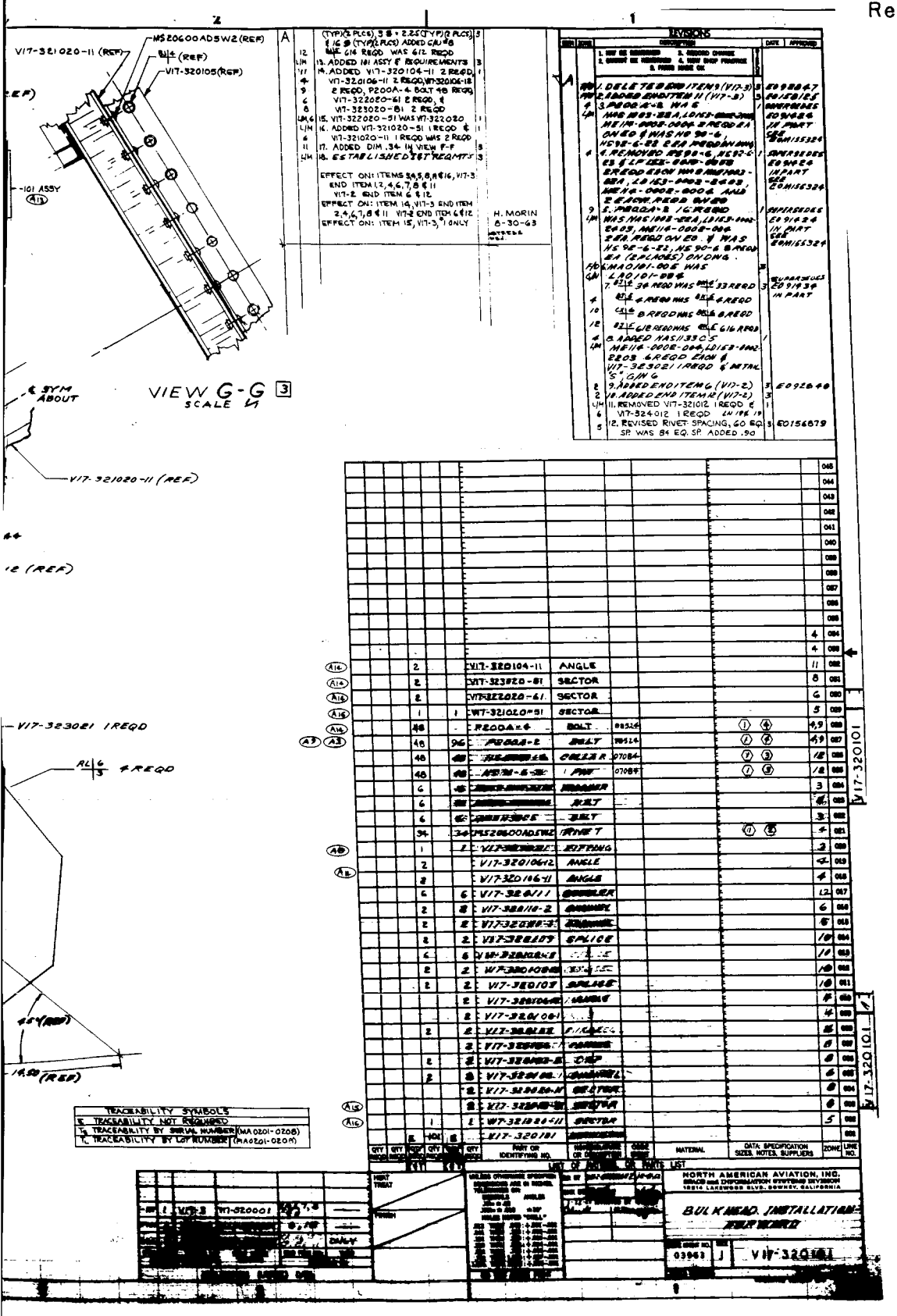
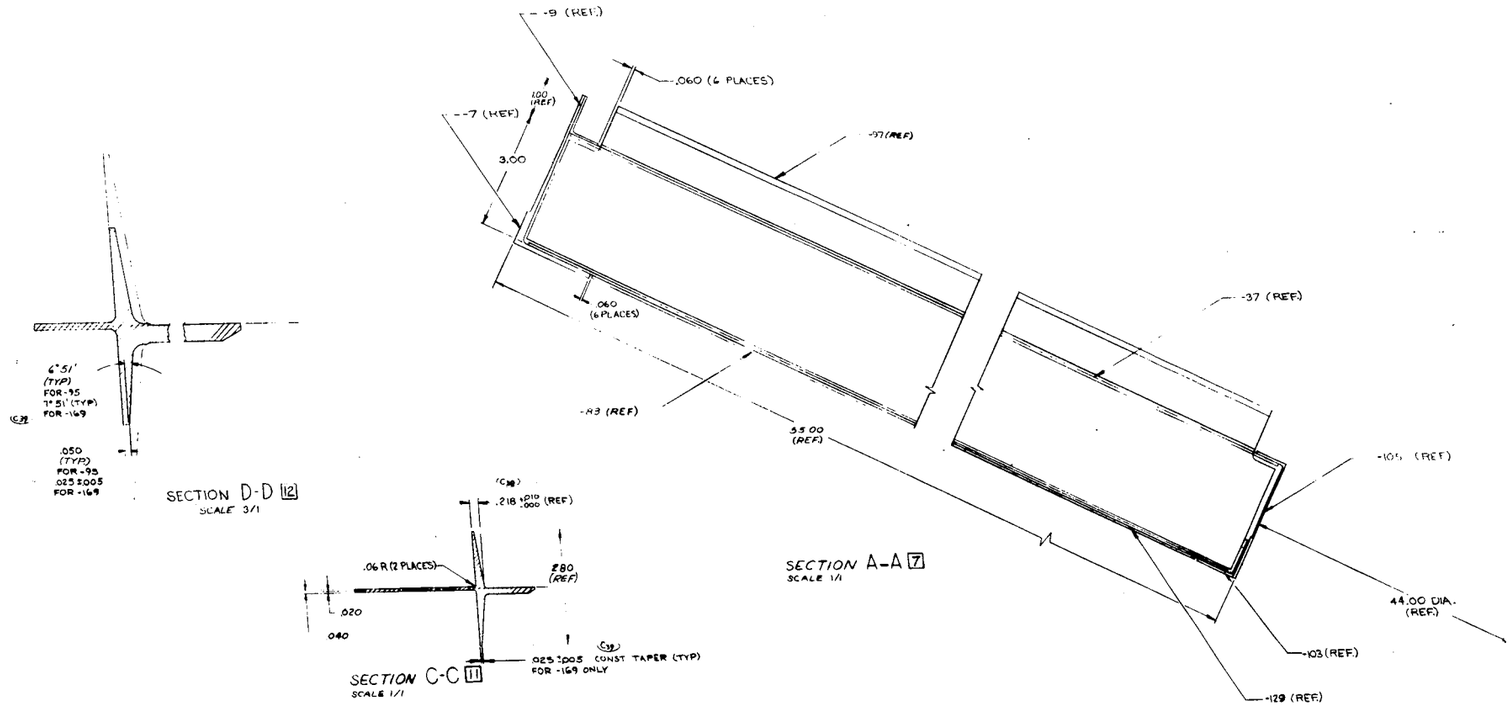


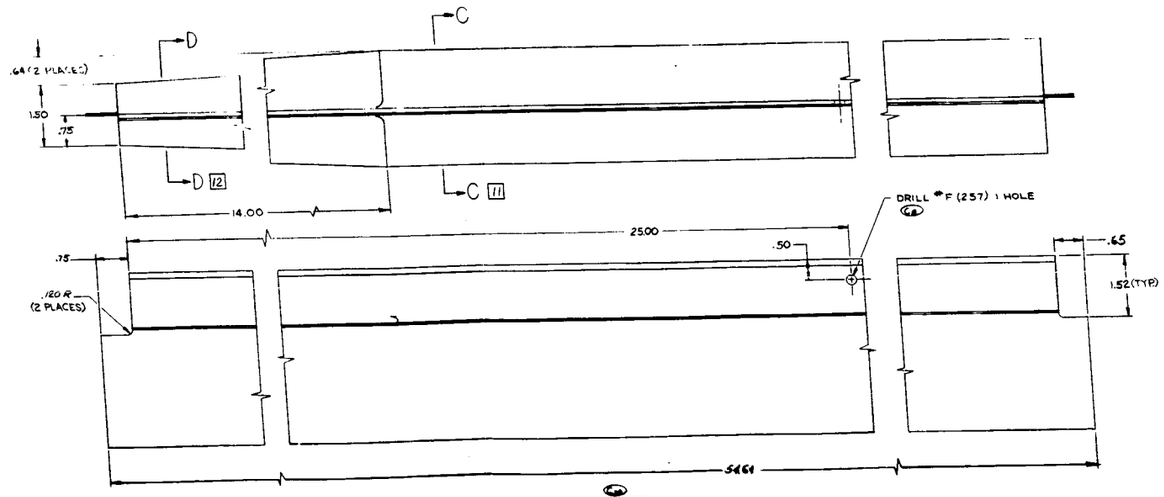
Figure 2-9. Installation of Forward Bulkhead (V17-320101)



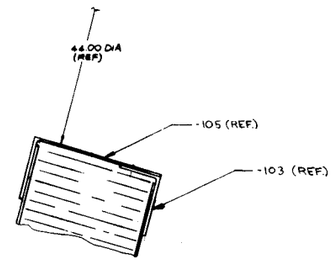
SECTION A-A [7]
SCALE 1/1

SECTION D-D [12]
SCALE 3/1

SECTION C-C [11]
SCALE 1/1



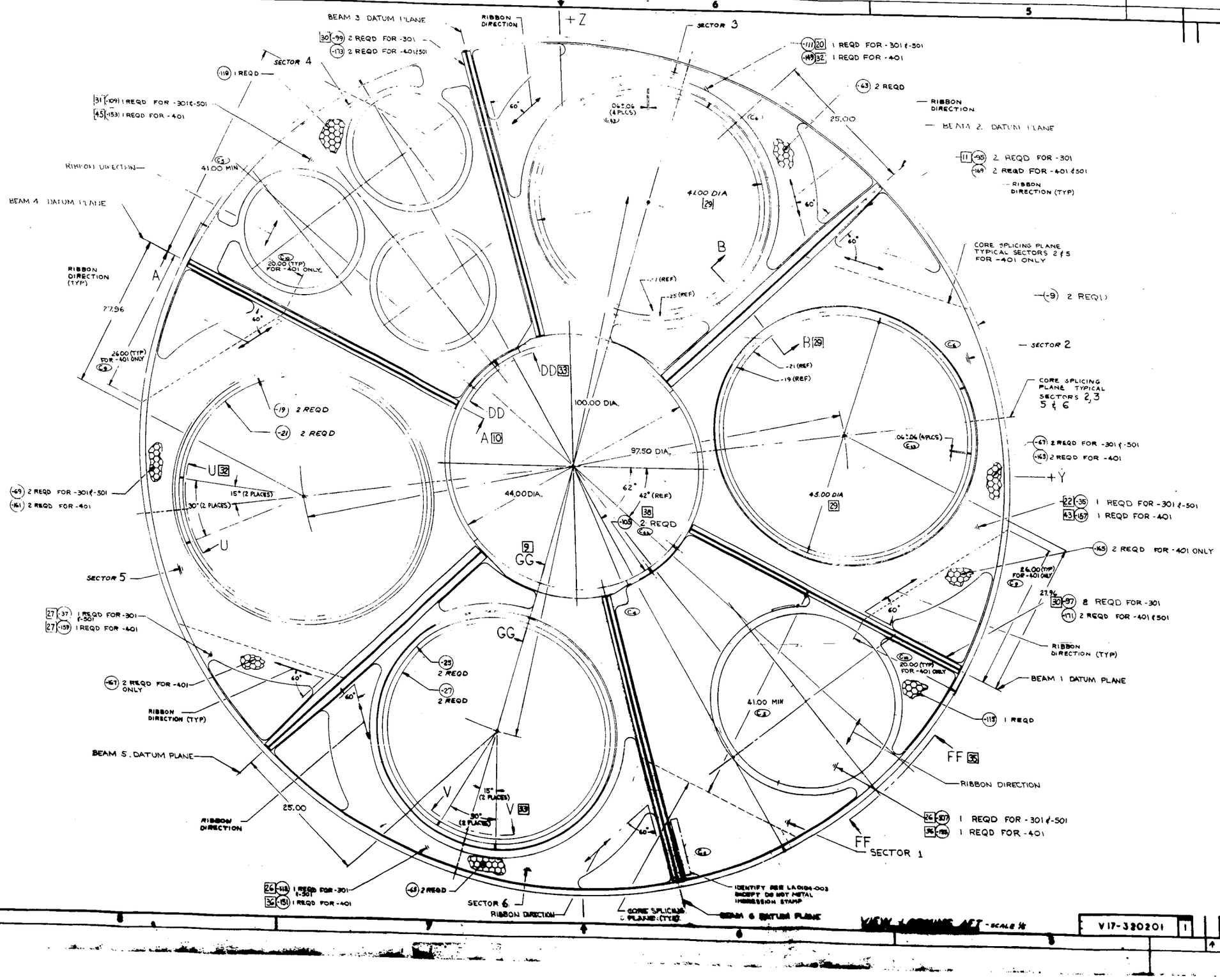
DETAIL -95 & -169 [5]
SCALE 1/1 DETAIL -169 SAME AS -95
SECRET AS SHOWN



SECTION GG-GG [7]
SCALE 1/1

V17-320201

2



12. FOR ZONES 1 THRU 12 SEE SHEET 1
FOR ZONES 13 THRU 24 SEE SHEET 2
FOR ZONES 25 THRU 36 SEE SHEET 3
FOR ZONES 37 THRU 43 SEE SHEET 4
11. ALL MACHINED SURFACES 125

8. FOR CONTOURS & BEVELS SEE MD-V14
7. MACHINE -95,-97,-99,-103,-105,-145,-169,-171,&-173 PER MA 0103-005
6. RIBBON DIRECTION OF HONEYCOMB SHOWN F/D (ZONES 2,6,7,8)
5. TD DENOTES THICKNESS DIMENSION
4. CHEM-MILLED RADII AS ETCHED
3. CHEM-MILL PER LA 0103-004 OR MACHINE PER MA 0103-005
2. FABRICATE DETAILS PER LA 0102-004 & BOND ALL DETAILS PER MA 0106-002
1. STANDARD DETAIL PER MA 0102-002

NOTES: UNLESS OTHERWISE SPECIFIED

VIEW LOOKING AFT - SCALE ½

V17-330201 1

3

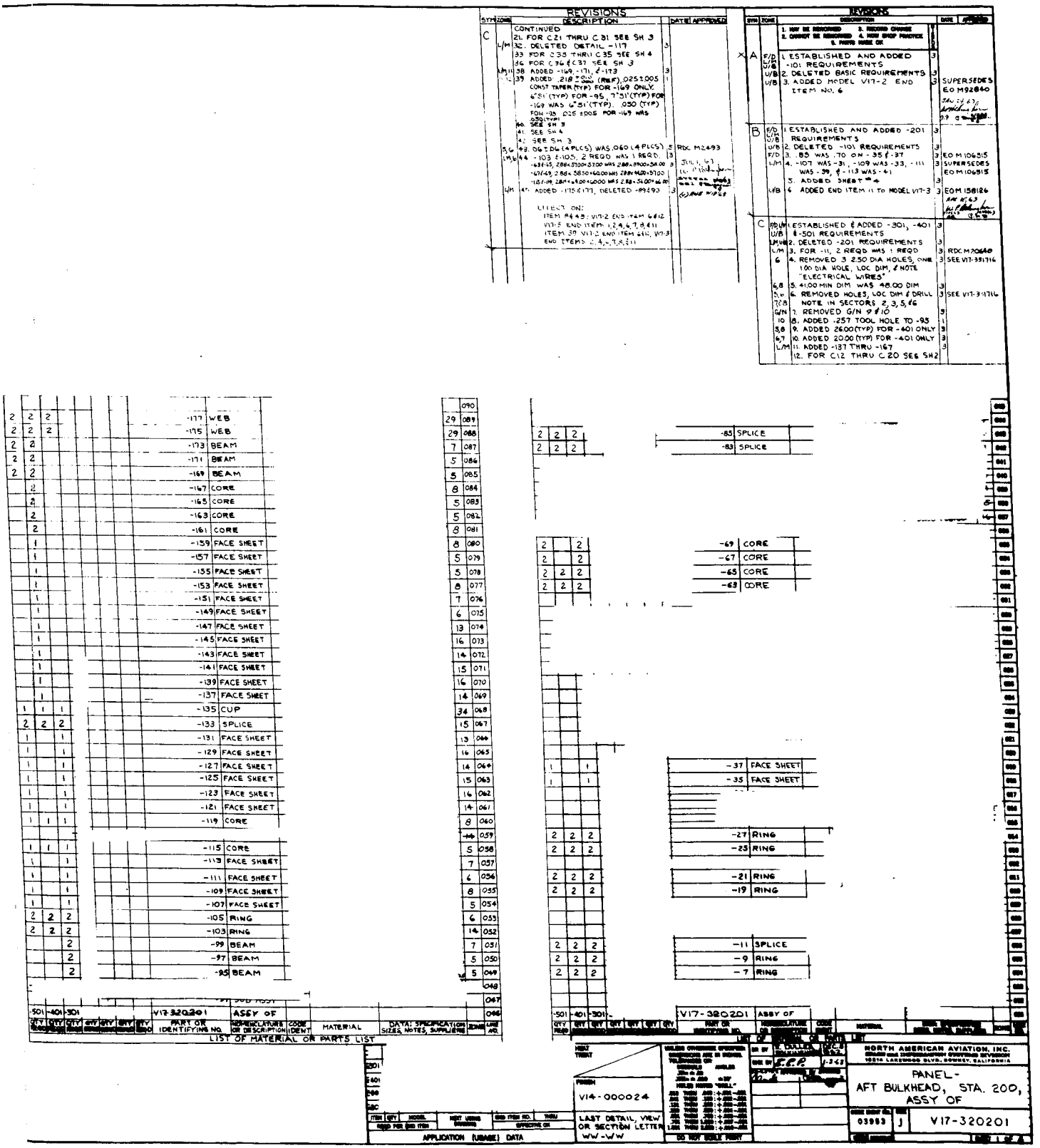
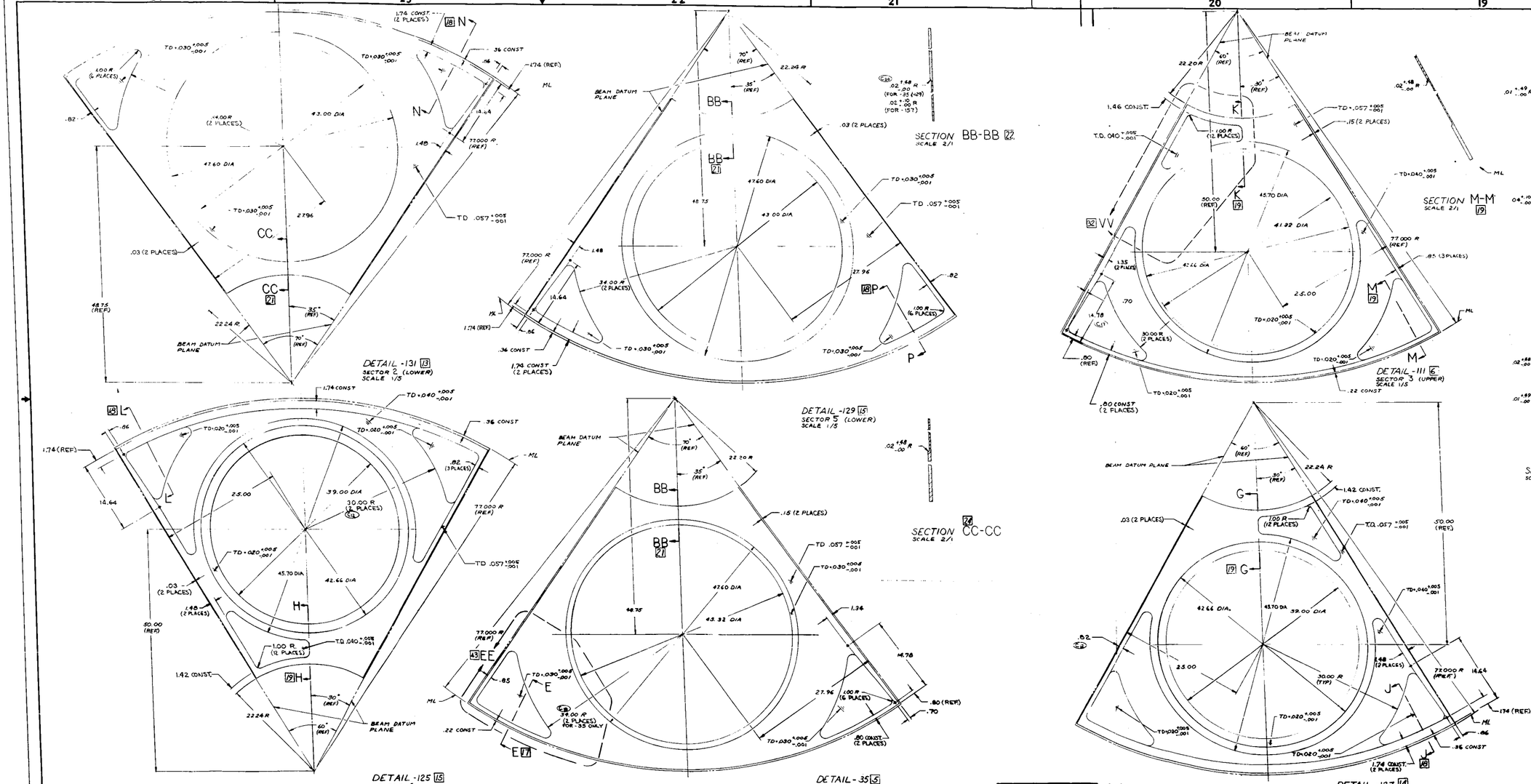


Figure 2-10. Assembly of Aft Bulkhead, Station X_S 200 (V17-320201-1)


DETAIL -131 13
SECTOR 2 (LOWER)
SCALE 1/5
SECTION BB-BB 22
SCALE 2/1
DETAIL -129 15
SECTOR 5 (LOWER)
SCALE 1/5
SECTION CC-CC 24
SCALE 2/1
DETAIL -111 16
SECTOR 3 (UPPER)
SCALE 1/5
SECTION K-K 20
SCALE 2/1
SECTION M-M 19
SCALE 2/1
SECTION L-L 24
SCALE 2/1
SECTION H-H 23
SCALE 2/1
DETAIL -125 15
SECTOR 6 (LOWER)
SCALE 1/5
DETAIL -35 15
SECTOR 2 (UPPER)
SCALE 1/6
DETAIL -127 14
SECTOR 3 (LOWER)
SCALE 1/6
SECTION G-G 20
SCALE 2/1
SECTION J-J 19
SCALE 2/1
SECTION N-N
SCALE 2/1
V17-320201 2

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SPACE and INFORMATION SYSTEMS DIVISION

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Date: 2-19-64
Rev. Date:

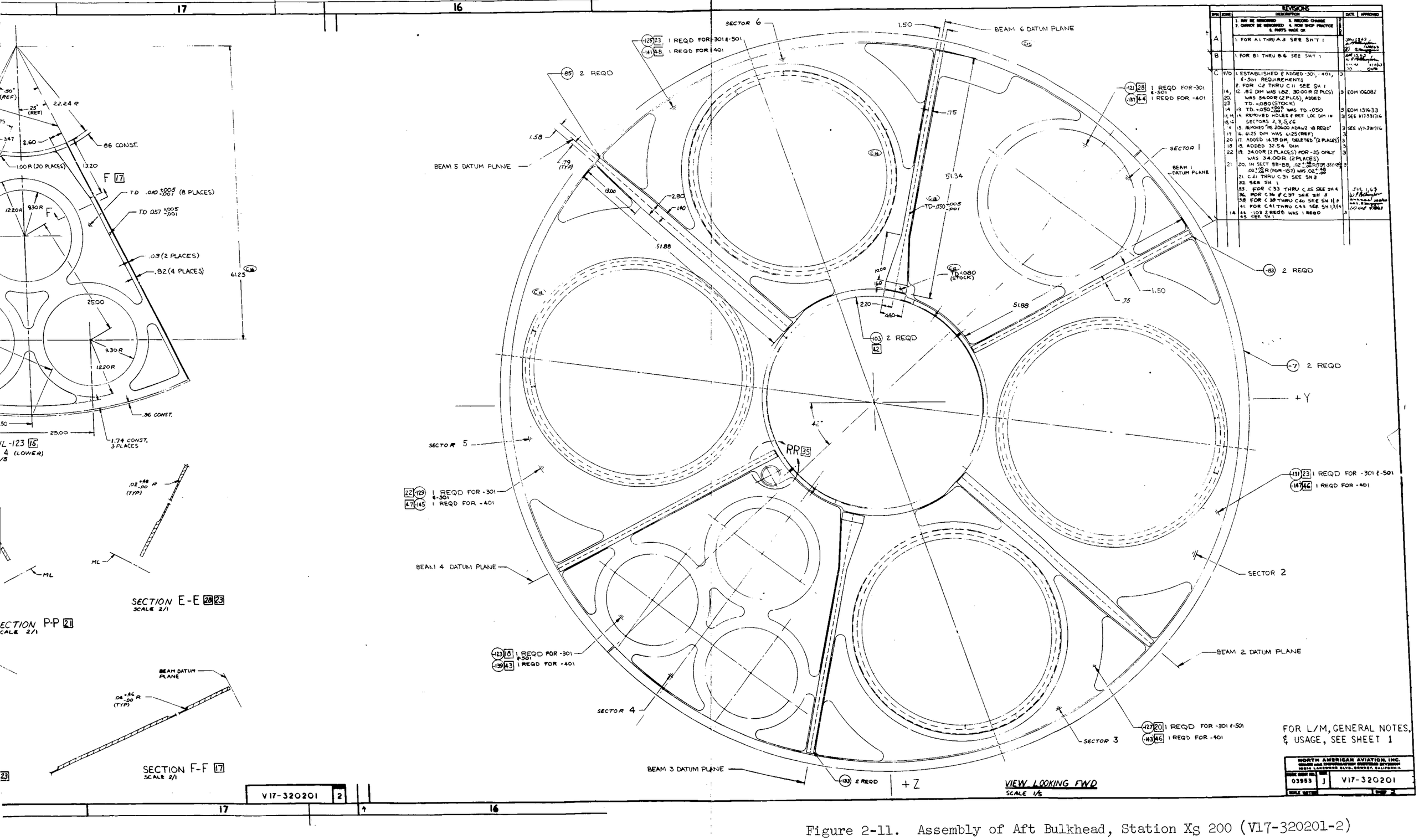


Figure 2-11. Assembly of Aft Bulkhead, Station Xs 200 (V17-320201-2)

36 35 34 33 32

TRACE 42° LINE

2.75

.75

.75

2.00

4.00

SECTION TT (REF 16)
SCALE 1/1

TRACE 15° LINE

TRACE 30° LINE

VIEW VV 17
SCALE

44.00 DIA
(REF)

VIEW WW 26
DETAIL -151
SECTOR 6 (UPPER)
SCALE 1/5
DETAIL SAME AS -113 ZONE 26
EXCEPT AS SHOWN

4.38 (REF)

TD=010 (REF)

SS[64]

100R (3 PLACES)

VIEW RR 15
SCALE 1/1

55 (4 PLACES)

TD=057 (REF)

TRUE HEADING DATUM PLANE

023 (TRUE)

VIEW XX 27
SCALE 1/1

VIEW VV 00
DETAIL -149
SECTOR 6 (UPPER)
SCALE 1/5
DETAIL SAME AS -111
EXCEPT AS SHOWN

DETAIL -155
SECTOR 1 (UPPER)
SCALE 1/5
DETAIL SAME AS -107 ZONE 26
EXCEPT AS SHOWN

SECTION SS-SS (REF)
SCALE 1/1

V17-320201 31

36 35 34 33 32

2

31 | 30 | 29 | 28 | 27

REAM DATUM PLANE

SECTION [31]-[27] (REF)
SCALE 2/1

DETAIL-109 [8]
SECTOR A (UPPER)
SCALE 1/5

SECTION B-B [6]
SCALE 1/1

SECTION AA-AA [28]
SCALE 2/1

DRILL #F (.257) HOLE

SECTION TT [29]

VIEW TT [30]
-99 & 173 ONLY
SCALE 1/1

DETAIL -37 & -159 [5]
SECTOR 5 (UPPER)
SCALE 1/5

DETAIL-121 [14]
SECTOR 1 (LOWER)
SCALE 1/5

V17-320201 3

31 | 30 | 29 | 28 | 27

3

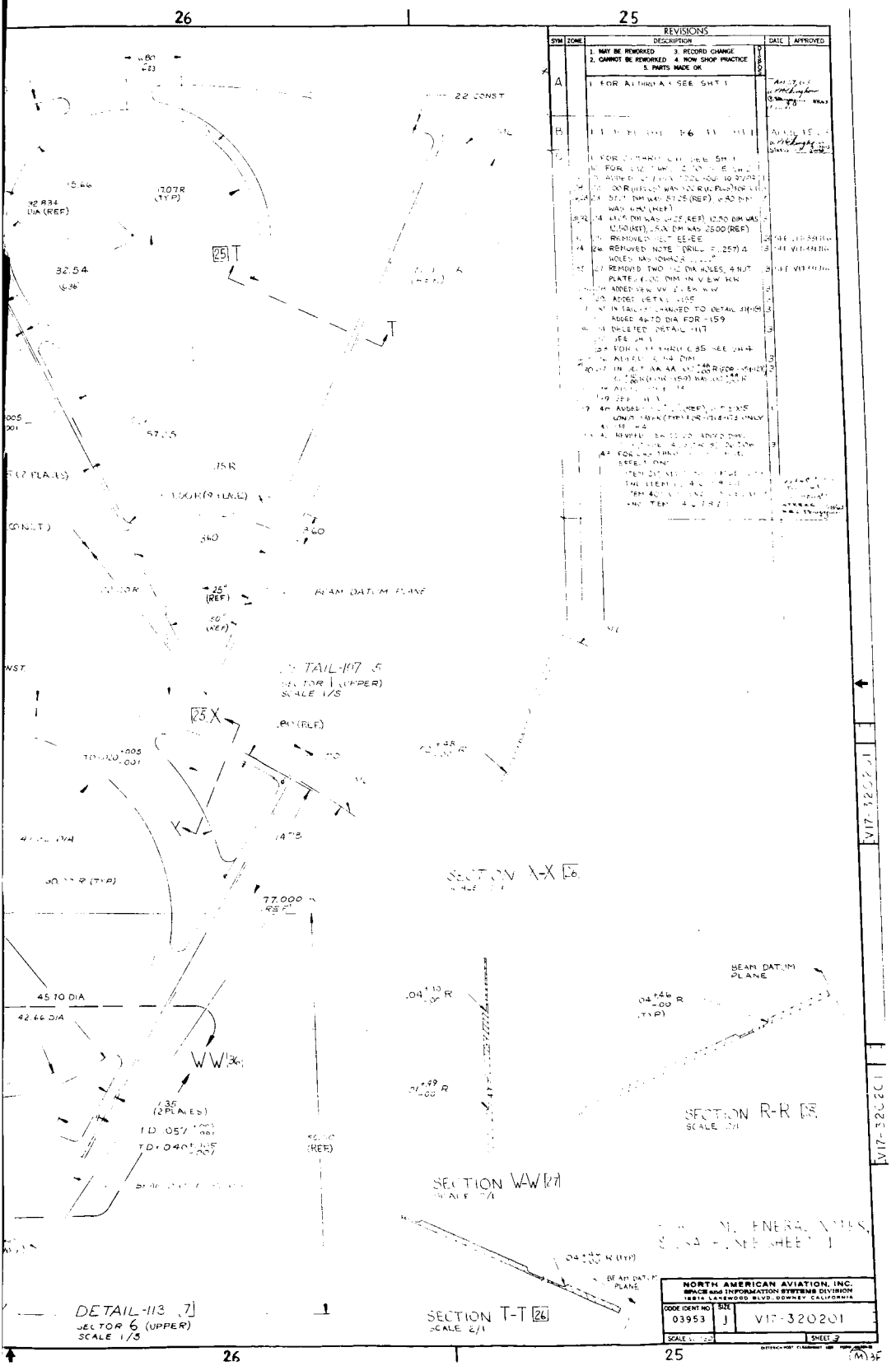
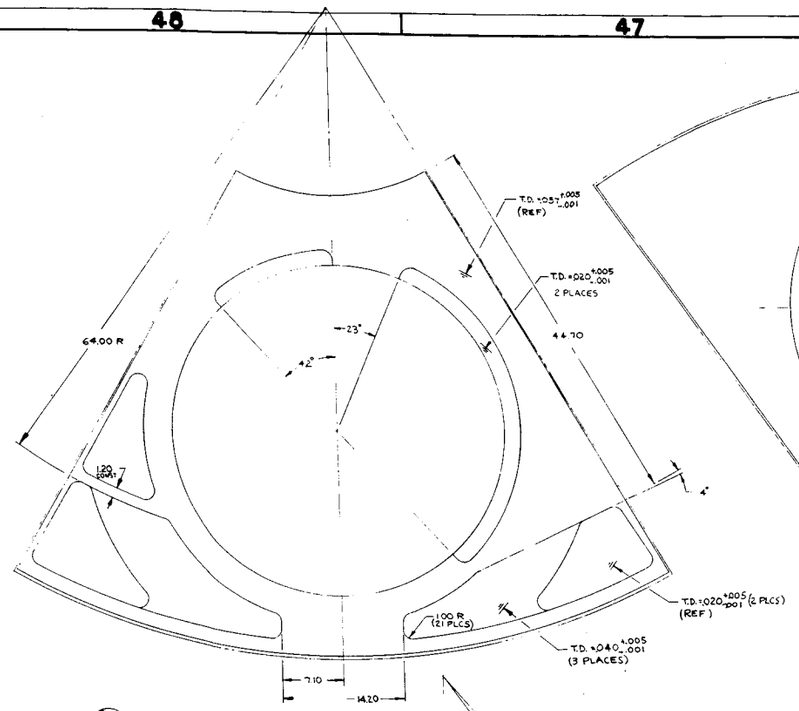
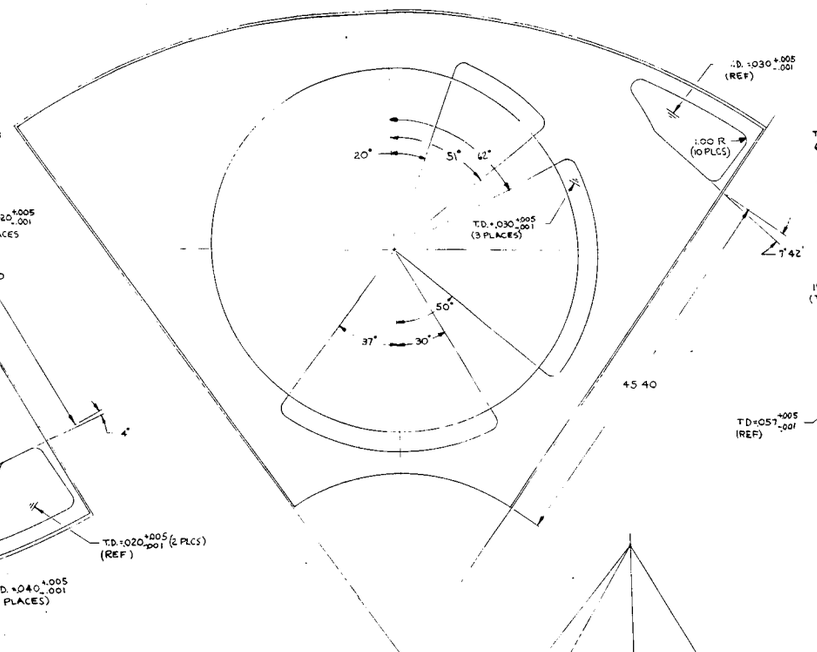


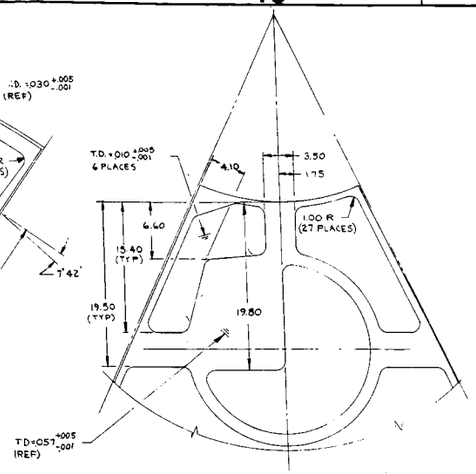
Figure 2-12. Assembly of Aft Bulkhead, Station X_S 200 (V17-320201-3)



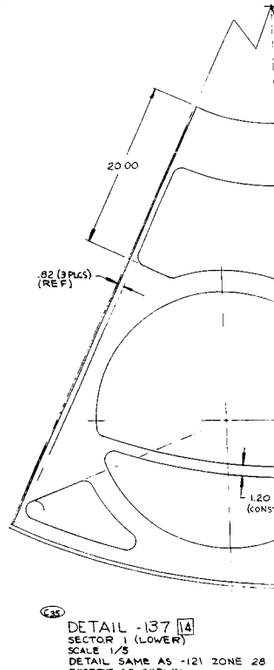
DETAIL - 141 15
SECTOR 6 (LOWER)
SCALE 1/5
DETAIL SAME AS - 125 ZONE 23
EXCEPT AS SHOWN



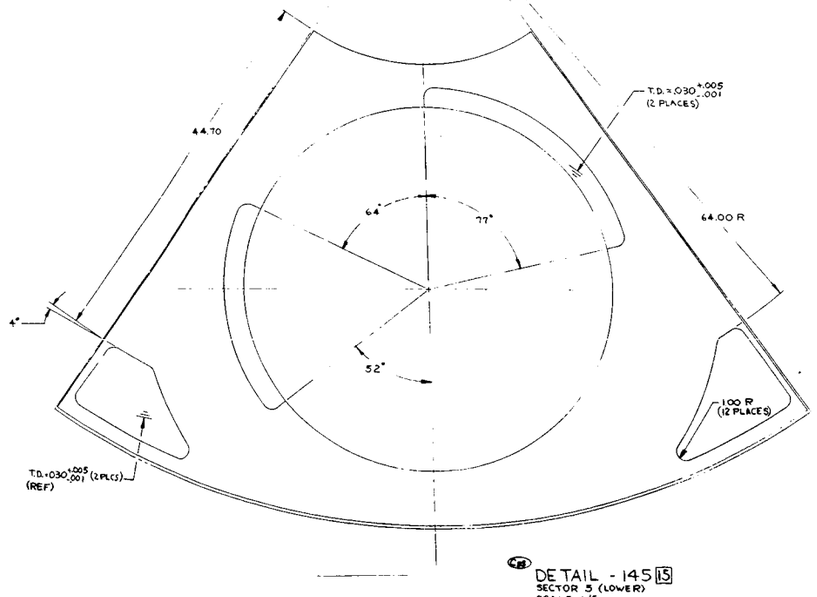
DETAIL - 147 13
SECTOR 2 (LOWER)
SCALE 1/5
DETAIL SAME AS - 131 ZONE 23
EXCEPT AS SHOWN



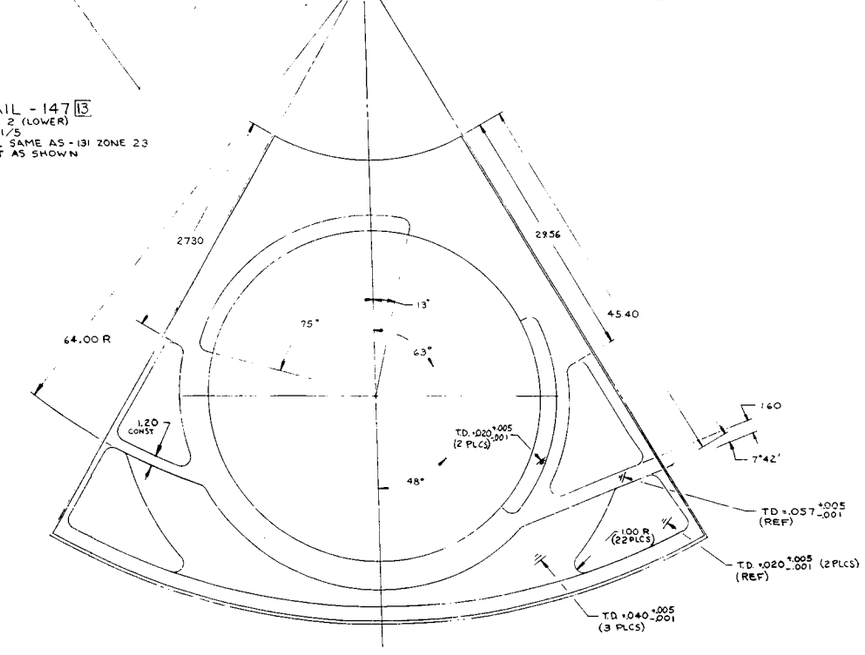
VIEW UU 31
DETAIL - 153 8
SECTOR 4 (UPPER)
SCALE 1/3
DETAIL SAME AS - 109 ZONE 31
EXCEPT AS SHOWN



DETAIL - 137 14
SECTOR 1 (LOWER)
SCALE 1/5
DETAIL SAME AS - 121 ZONE 28
EXCEPT AS SHOWN



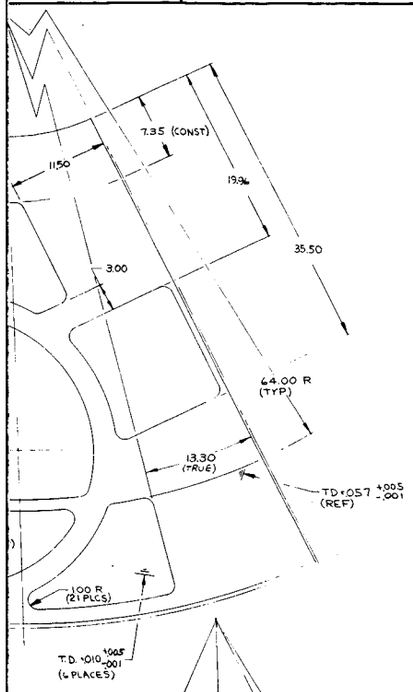
DETAIL - 145 15
SECTOR 5 (LOWER)
SCALE 1/5
DETAIL SAME AS - 129 ZONE 22
EXCEPT AS SHOWN

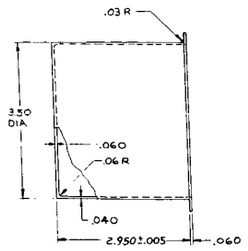


DETAIL - 143 14
SECTOR 3 (LOWER)
SCALE 1/5
DETAIL SAME AS - 127 ZONE 20
EXCEPT AS SHOWN

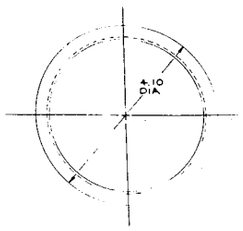
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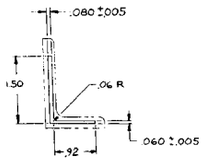
43 | 42 | 41 | 40



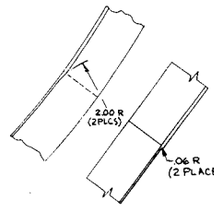


DETAIL -135 34
SCALE 1/1

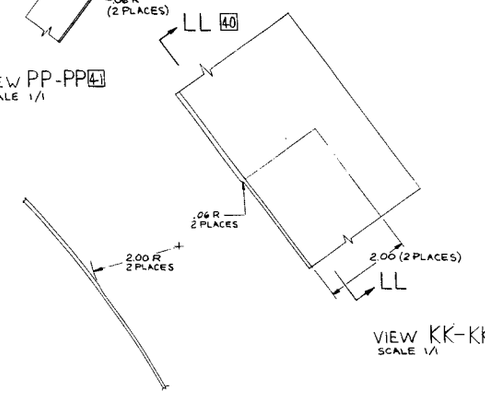




SECTION MM-MM 42
SCALE 1/1

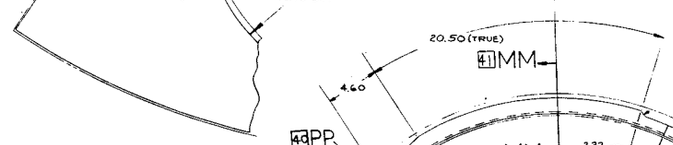


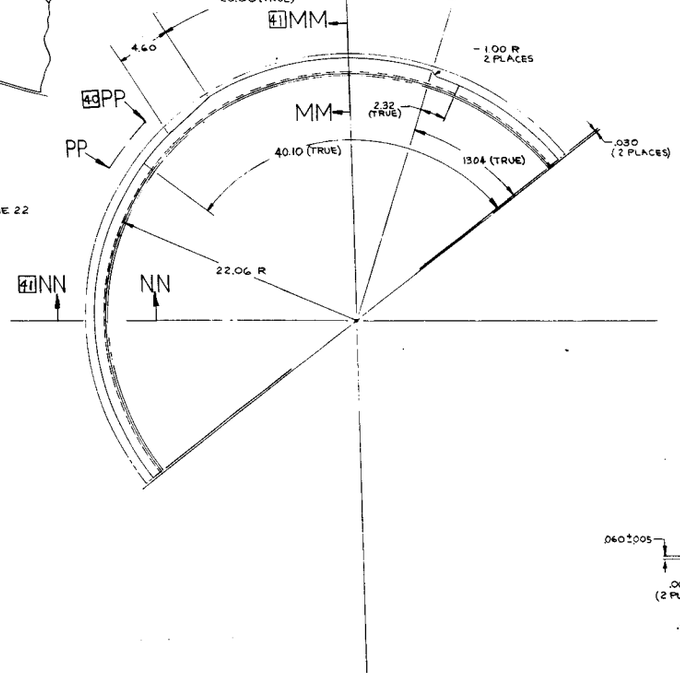
VIEW PP-PP 43
SCALE 1/1

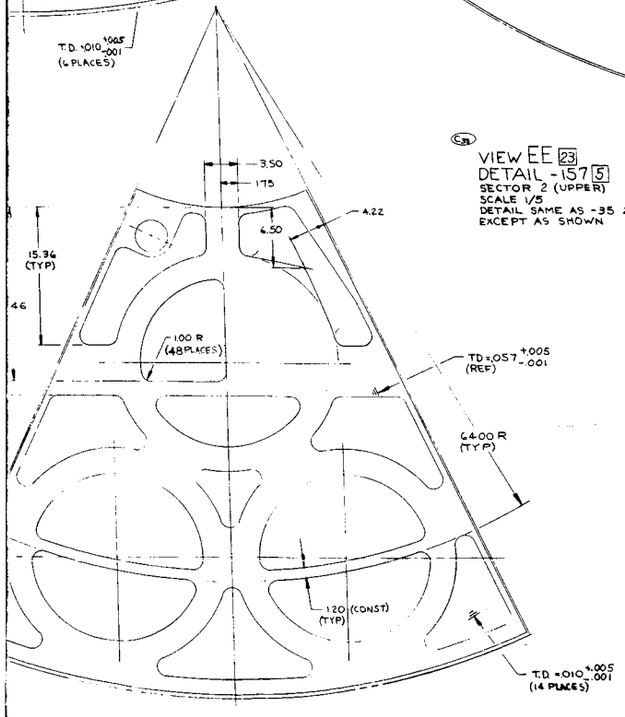


VIEW KK-KK 38
SCALE 1/1

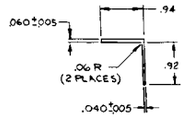
SECTION LL-LL 39
SCALE 1/1



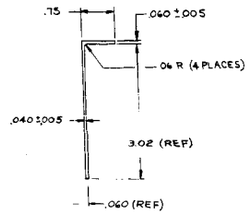




(C39) VIEW EE 23
DETAIL -157 5
SECTOR 2 (UPPER)
SCALE 1/5
DETAIL SAME AS -35 ZONE 22
EXCEPT AS SHOWN



SECTION NN-NN 41
SCALE 1/1



SECTION JJ-JJ 39
SCALE 1/1

(C41) DETAIL -103 14
SCALE 1/4

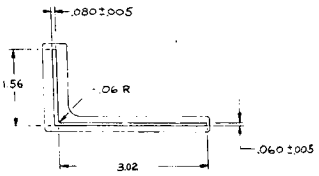
(C32) DETAIL -139 15
SECTOR 4 (LOWER)
SCALE 1/5
DETAIL SAME AS -123 ZONE 18
EXCEPT AS SHOWN

V17-320201 4

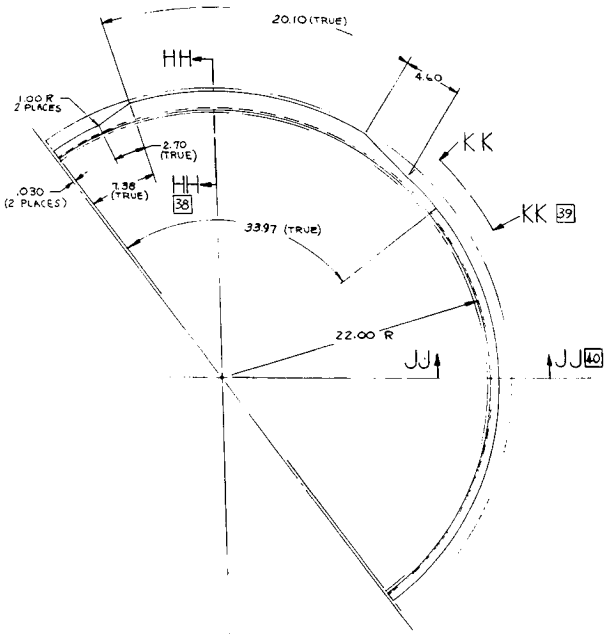
43 | 42 | 41 | 40

3

REVISIONS			
SYM	ZONE	DESCRIPTION	DATE / APPROVED
		1. MAY BE REWORKED 3. RECORD CHANGE 2. CANNOT BE REWORKED 4. NOW SHOP PRACTICE 5. PARTS MADE OK	
B		1. FOR A1 THRU A3 & B1 THRU B6 SEE SHEET 1	APRIL 15, 63
C		1. FOR C1 THRU C11 SEE SH 1 12. FOR C12 THRU C21 SEE SH 2 22 FOR C22 THRU C31 SEE SH 1 & 3 32 SEE SH 1	
	43	33. ADDED VIEW EE	3
	45	34. ADDED VIEW UU	3
	43,44, 46-48	35. ADDED DETAIL -137 THRU -147	3
		36. FOR C36 & C37 SEE SH 3	
		38 FOR C38 THRU C40 SEE SH 1 & 3	
	38,42-41	CHANGED DETAIL -103: 4.60 WAS 4.60 (2 PLCS), 20.50 (TRUE) WAS 20.50 (TRUE) (2 PLCS), 40.10 (TRUE) WAS 20.10 (TRUE) (2 PLCS), 22.04 R WAS 44.12 DIA, DELETED 19.20 (TRUE), ADDED 13.04 (TRUE), DELETED 4.20 (TRUE) ADDED 2.32 (TRUE), DELETED .03 R .06, ADDED .030 (2 PLCS), DELETED 7.35 (TRUE) 2 PLCS CHANGED DETAIL -105: 4.60 WAS 4.60 (2 PLCS), 20.10 (TRUE) WAS 20.10 (TRUE) (2 PLCS), 1.00 R (2 PLCS) WAS 1.00 R (4 PLCS), 33.97 (TRUE) WAS 20.10 (TRUE) 2 PLCS, 22.00 R WAS 44.00 DIA, DELETED 19.17 (TRUE) ADDED 7.38 (TRUE), DELETED 9.20 (2 PLCS), ADDED 2.70 (TRUE), DELETED .03 R .06, ADDED .030 (2 PLCS), DELETED 6.95 (TRUE) 2 PLCS	1
		42. FOR C42 THRU C45 SEE SH 1,2,&3 EFFECT ON: ITEM 41; V17-2 END ITEM & 12, V17-3 END ITEM 1, 2, 4, 6, 7, 8, & 11	(C) 2&3 7/9/63 W P Billington 7/11/63 SYSTEMS ENG.



SECTION HH-HH 38
SCALE 1/1

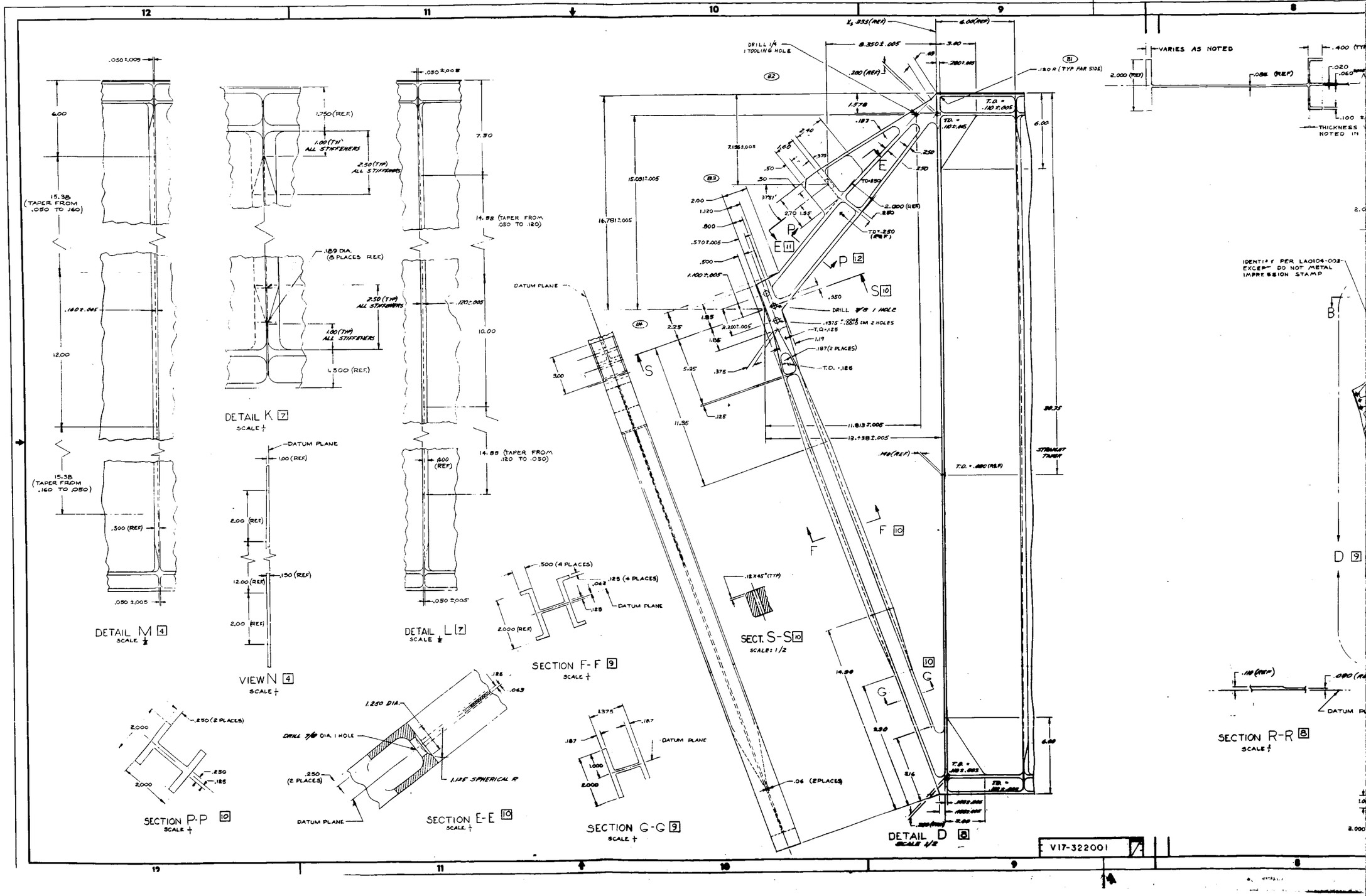


(C&I)
DETAIL -105 6
SCALE 1/4

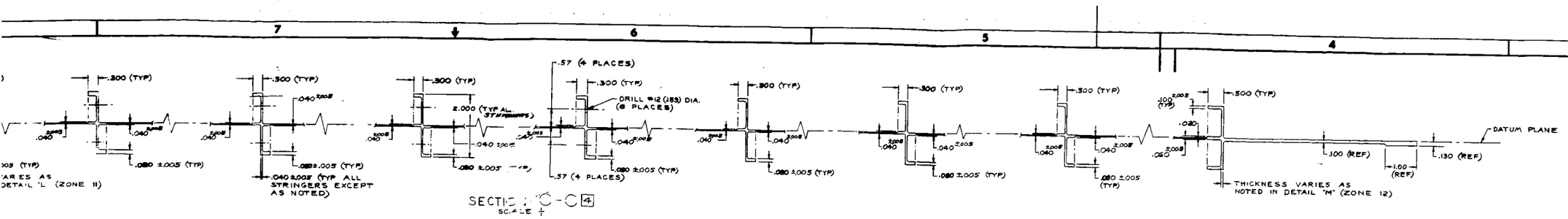
FOR L/M, GENERAL NOTES, & USAGE, SEE SHEET 1

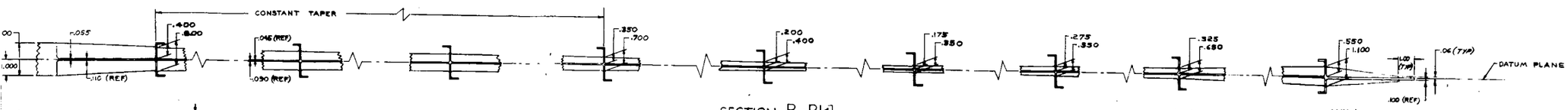
NORTH AMERICAN AVIATION, INC. SPACE and INFORMATION SYSTEMS DIVISION 12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA		
CODE IDENT NO. 03953	SIZE J	V17-320201
SCALE NOTED		SHEET 4

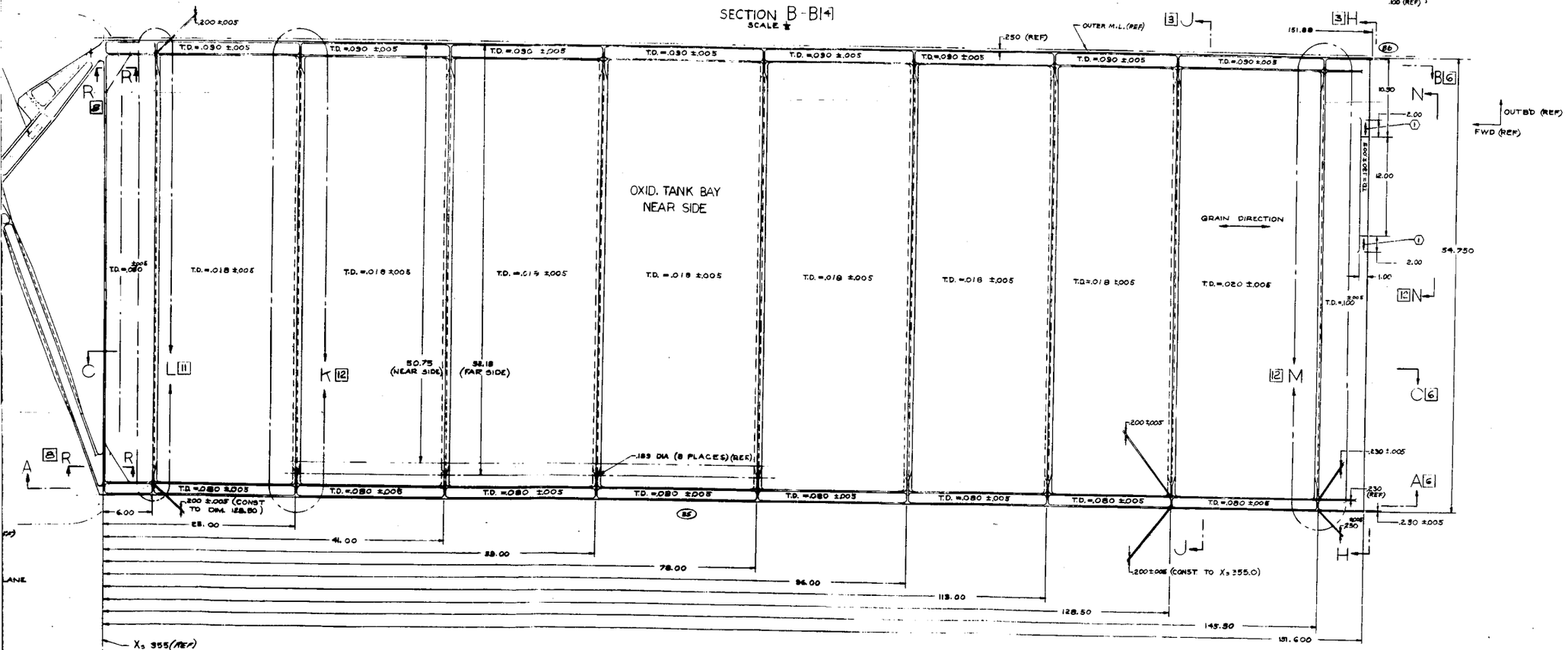
Figure 2-13. Assembly of Aft Bulkhead, Station Xs 200 (V17-320201-4)

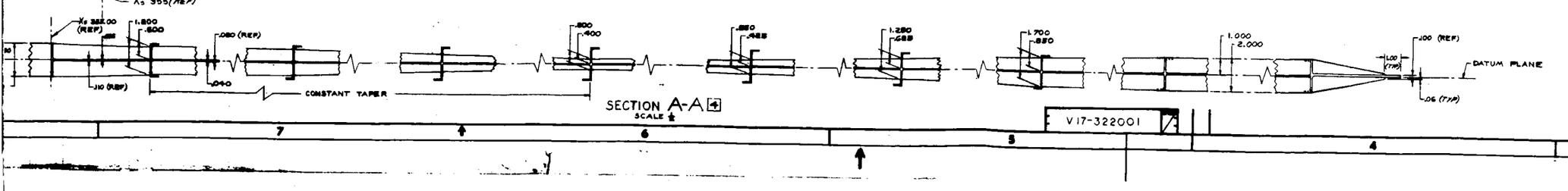

12
11
10
9
8
DETAIL M 4
SCALE 1/2
VIEW N 4
SCALE 1
DETAIL K 7
SCALE 1
DETAIL L 7
SCALE 1/2
SECTION F-F 9
SCALE 1
SECTION P-P 10
SCALE 1
SECTION E-E 10
SCALE 1
SECTION G-G 9
SCALE 1
SECT. S-S 10
SCALE: 1/2
DETAIL D 8
SCALE 1/2
SECTION R-R 8
SCALE 1
DATUM PLANE
DRILL 1/4 TOOLING HOLE
VARIES AS NOTED
THICKNESS NOTED IN
IDENTIFY PER LA0104-003 EXCEPT DO NOT METAL IMPRESSION STAMP
STRAIGHT THREAD
V17-322001

2









1. IDENTIP & TRACEABILITY PER MA0101-0206
2. & MUST BE FLAT WITHIN 3/16 IN ANY DIRECTION
1. S. DENOTES TAPER DIRECTION
4. SYMBOL T.D. DENOTES THICKNESS DIM
3. CORNER RADII .38
2. FILLET RADII .06
1. CHEM-MILL PER MA0103-004 OR MACHINE PER MA0103-005
NOTES: UNLESS OTHERWISE NOTED

V17-322001

3

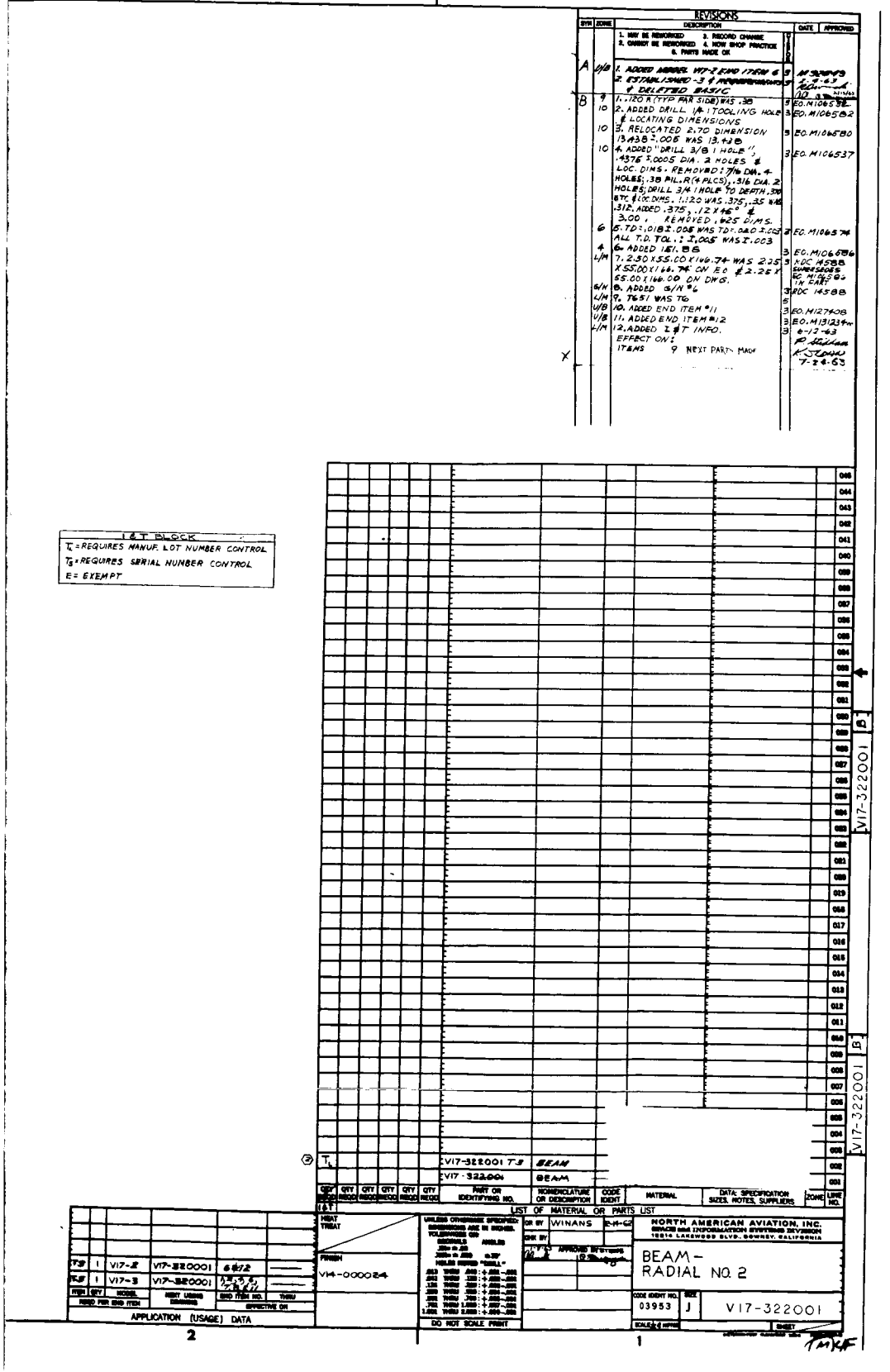


Figure 2-14. Assembly of Radial Beam 2 (V17-322001)

2.2.9 Functions of the radial beams are five: a) supporting structures for the C/M; b) transfer frames for propellant loads from the aft bulkhead to the S/M shell; c) transfer framework for SPS loads to the S/M and C/M; d) support structures for auxiliary equipment pertaining to S/M systems; e) adjuncts to the outer shell for the distribution of pressure loads.

2.3 Operating Conditions

2.3.1 In normal launch mission, the S/M with all its systems, including the SPS and RCS engines, will successfully perform all of the maneuvers required of the spacecraft (S/C) between lift-off and reentry. Among these maneuvers are the following: earth orbit with in-flight and ground-directed checks; injection into lunar trajectory; transpositional docking with LEM; mid-course correction; translunar flight; "free-turn" trajectory; lunar orbit; transpositional docking; and earth trajectory.

2.3.2 In a normal launch abort mission the S/M will use either or both of its propulsion systems in operations designed to successfully keep the S/C within orbit, or return it to the earth.

2.4 Characteristics and Criteria - Component Design

2.4.1 The S/M outer shell, fairing, and radial beam structures will withstand the aerodynamic heating during boost. The internal structure of the S/M is designed for a temperature range between -200 and +300 F, although temperature and load conditions are not always concurrent. The S/M structure is designed to withstand hazards imposed by the environment as described by the environmental requirements listed in the NASA Exhibit B, Technical Specification, Part I, dated 3 January 1963. These requirements include resistance to the following: a) acoustics, vibration, and flight loads; b) extremes of humidity and temperature; c) high altitudes, ground handling, and transportation; d) salt-in-air, ground winds, storm conditions, meteoritic storms, and radiation.

2.4.2 Other and more technical criteria which have been used to fix the design of the S/M components are found in the Apollo Requirements Manual (ARM) -6, "Structural Loads and Criteria."

2.5 Test Requirements

2.5.1 Test requirements for the S/M outer shell, fairing, radial beams, and other internal structural components including mounting-provisions structures are specifically called out in SID 62-109-2, "General Test Plan, Research and Development for Project Apollo Spacecraft - Individual System Test."

2.5.2 Tests which have been completed and for which Apollo Test Reports (ATR's) have been released are listed here:

ATR NO.	NAME OF TEST
301-7	Joint - S/M to Adapter
301-9	Circumferential Edge Member
301-10	Longitudinal Edge Member
301-12	Structural Component Test - S/M Outer Shell Panel, Blind Rivet Joint Tests
301-14	Structural Component Test - Aluminum Honeycomb Sandwich
301-17	S/M Honeycomb Attachment Test
303(213)	S/M Meteroid Shielding
304	S/M Aft Bulkhead Structural Components Test
304-1	S/M Aft Bulkhead Structural Components Test, Bulkhead Splice and Shear Panel Tie

2.5.3 Tests which have been completed but for which no reports have been written are these:

ATR NO.	NAME OF TEST
301-1	S/M - Outer Shell Panel Test
301-3	S/M Simulated Aft Bulkhead Test
301-5	S/M Radial Shear Web Test

2.5.4 Scheduled tests as yet uncompleted are these:

ATR NO.	NAME OF TEST
300	S/M with Adapter Static Test
301-6	Fittings - C/M Support
304-2	Aft Bulkhead Component Test - S/M

2.5.5 ATR 600, Combined Module Static Structural Test, has not been run.

3.0 ADAPTER STRUCTURE

3.1 General and Configuration

3.1.1 Two S/M adapter structures are in preparation: the S-1 adapter and the S-5 or S/C LEM adapter. Drawing V18-000002, "Adapter General Assembly" (Figure 3-1) shows the S-1 configuration. Drawing V24-932002 (Figure 3-2) pictures a design proposed for the S-5 adapter.

3.1.2 Each adapter is a connecting structure between the S/M and the instrument package. Each serves as an enclosure for the lower portion of the main SPS engine and its attached cone, the aft heat shield below Station X_S 200, and the high-gain antenna in stowed position. Each adapter is made of aluminum honeycomb panels spliced together with pairs of longitudinal splice plates of aluminum. Each adapter structure is equipped with shaped-charge explosives for separation.

3.1.3 The S-1 adapter is a cylindrical structure formed of four equally sized rectangular panels which have a uniform thickness of two inches. Location of the S-1 adapter is between Stations X_D 200 and X_D 084. Drawing SK-015129 (Figure 3-3) is the manufacturing assembly breakdown for this adapter.

3.1.4 The S-5 adapter is a truncated conic structure with a conic angle of approximately nine degrees. Its panels vary in thickness. In addition to enclosing the same kinds of items mentioned in 3.1.2, the S-5 houses and supports the lunar excursion module (LEM).

3.2 Component Description

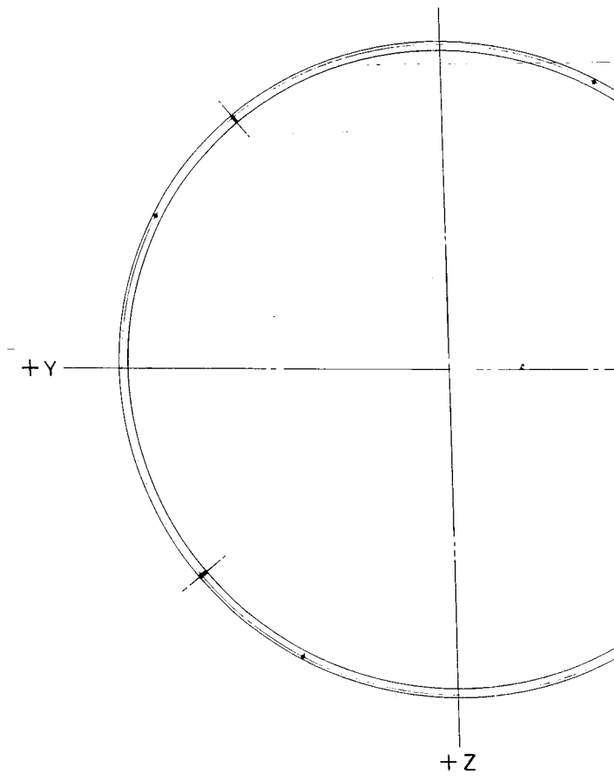
3.2.1 The panels of both S-1 and S-5 adapters are made of bonded aluminum honeycomb. This material was chosen for the same reasons as those given in 2.2.1.

3.2.2 Four pairs of longitudinal splice plates made of sheet aluminum 0.06-inch thick are used to bind the panels of the S-1 adapter together. Drawing V18-300011, "Skin Panel Splice for Adapter Plate" (Figure 3-4), displays details of the splice-plate configuration.

3.2.3 The function of the shell structure as formed by the use of the splice plates in both the S-1 and S-5 adapters is as follows:

12 11 10 9 8

A18-000005



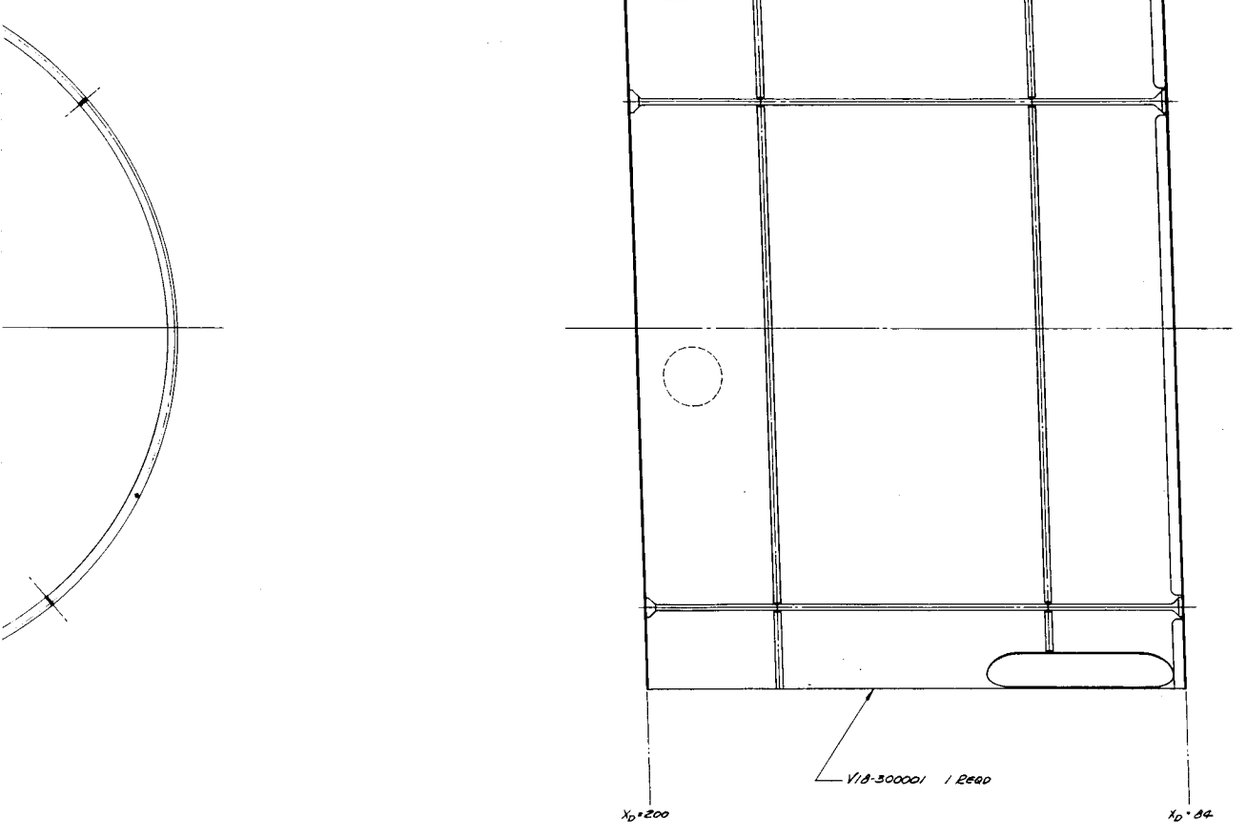
VIEW LOOKING AFT

V18-000002

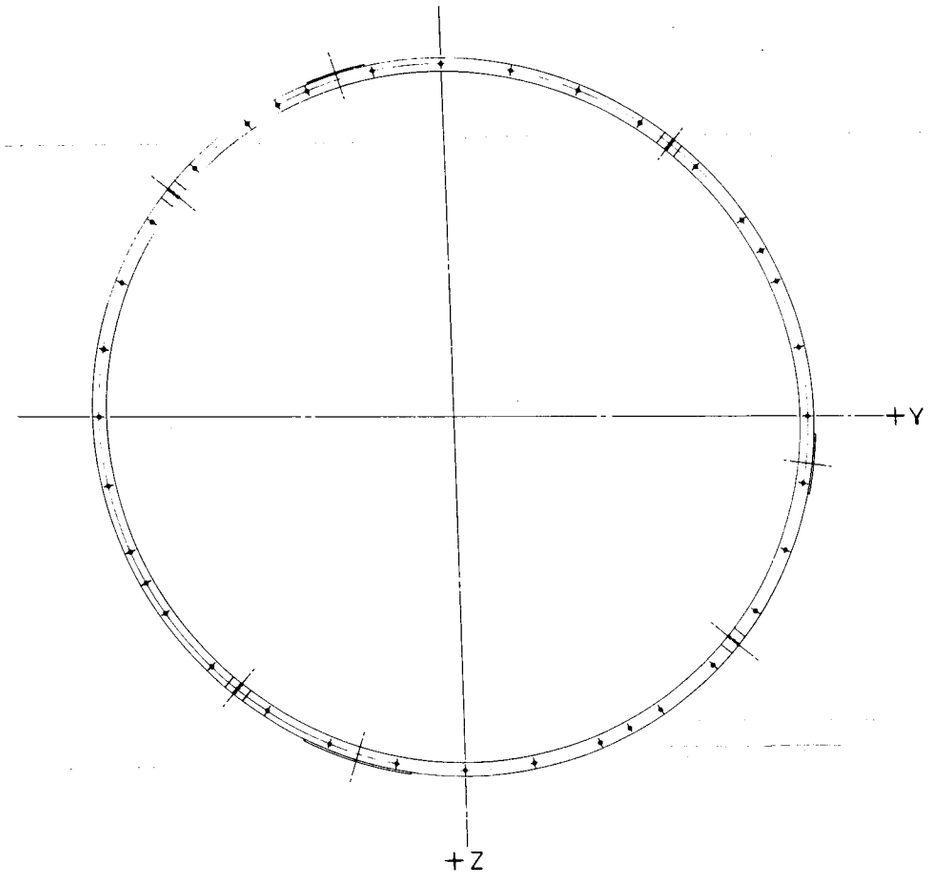
12 11 10 9 8

2

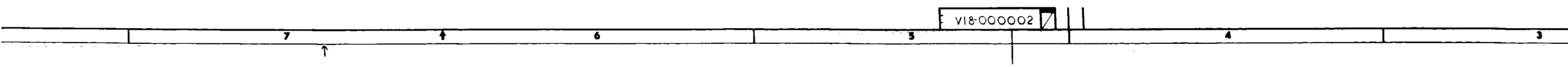




VIEW LOOKING INBOARD, L H SIDE



VIEW LOOKING FWD



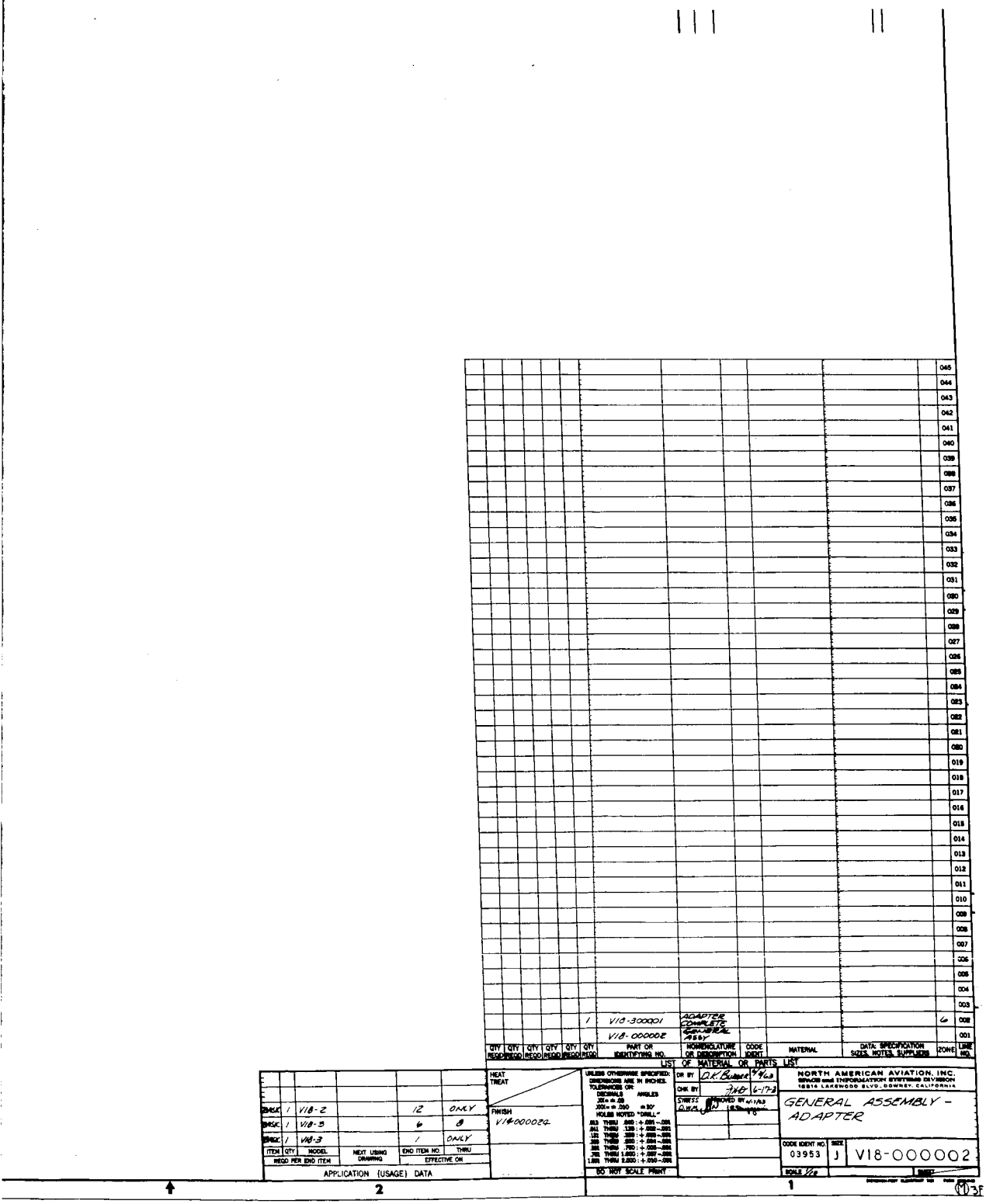
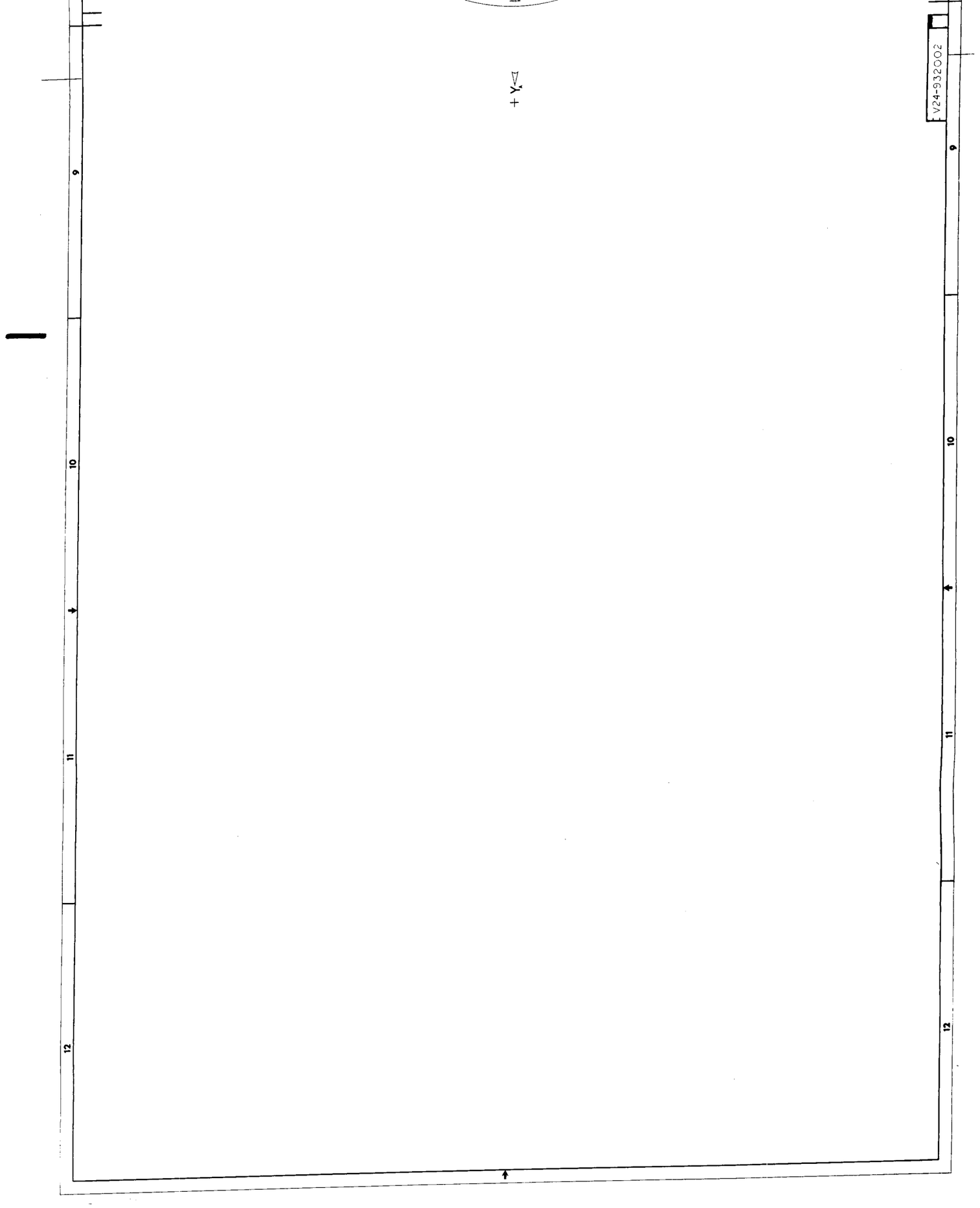
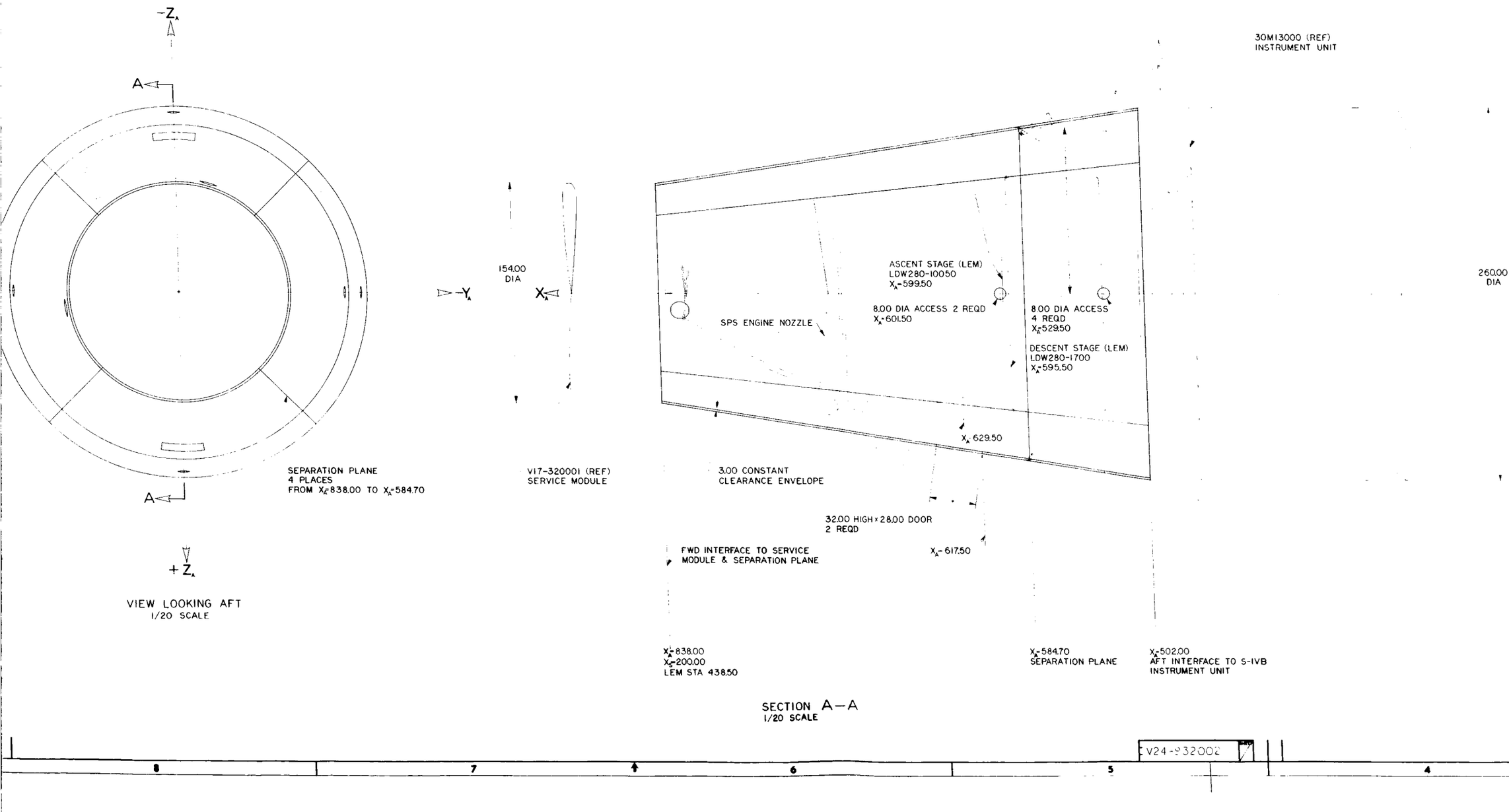


Figure 3-1. Adapter: General Assembly (V18-000002)


V24-932002
9
10
11
12

2



SECTION A—A
1/20 SCALE

V24-932002

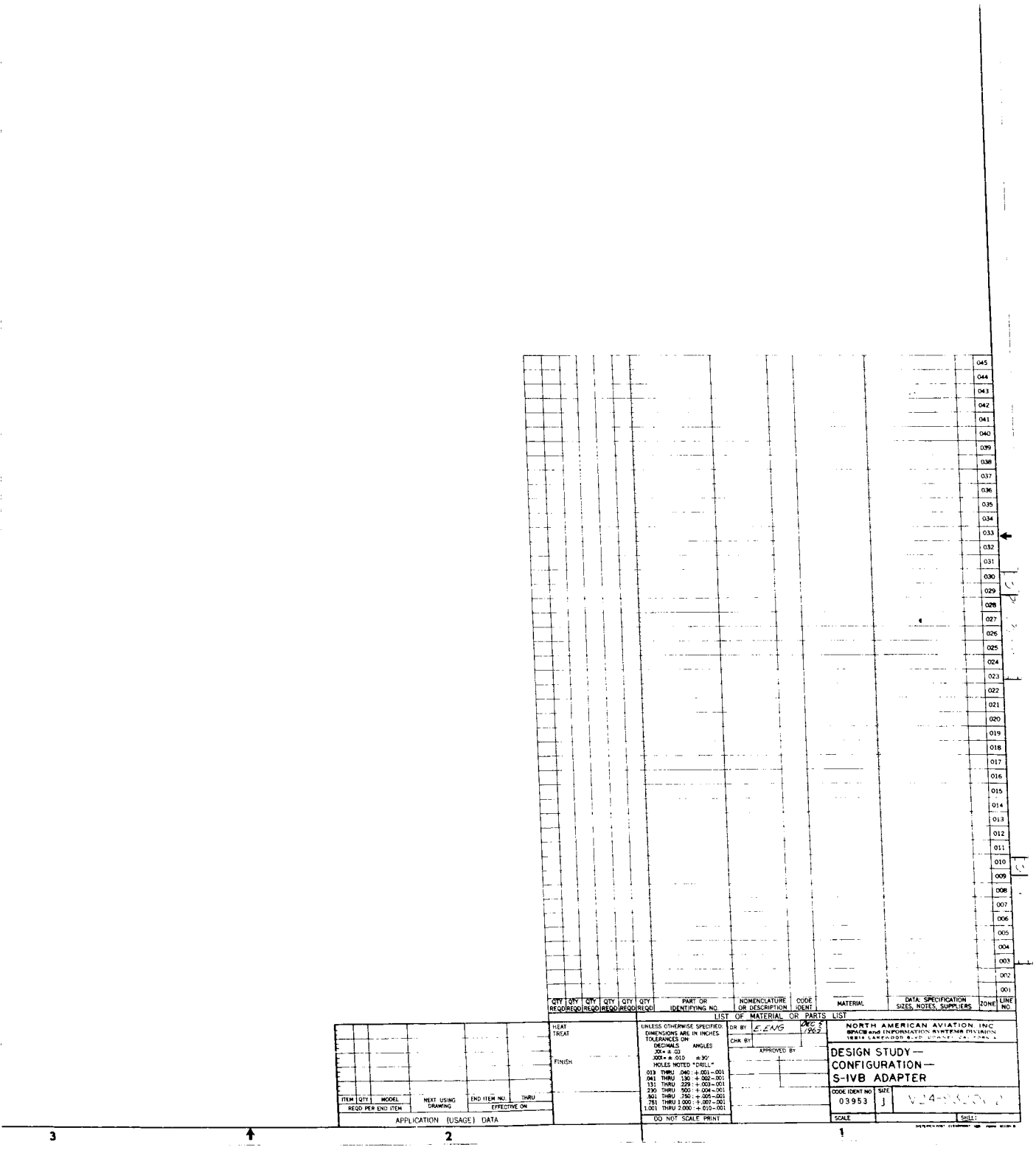


Figure 3-2. Design Study - Configuration - S-IV B Adapter (V24-932002)

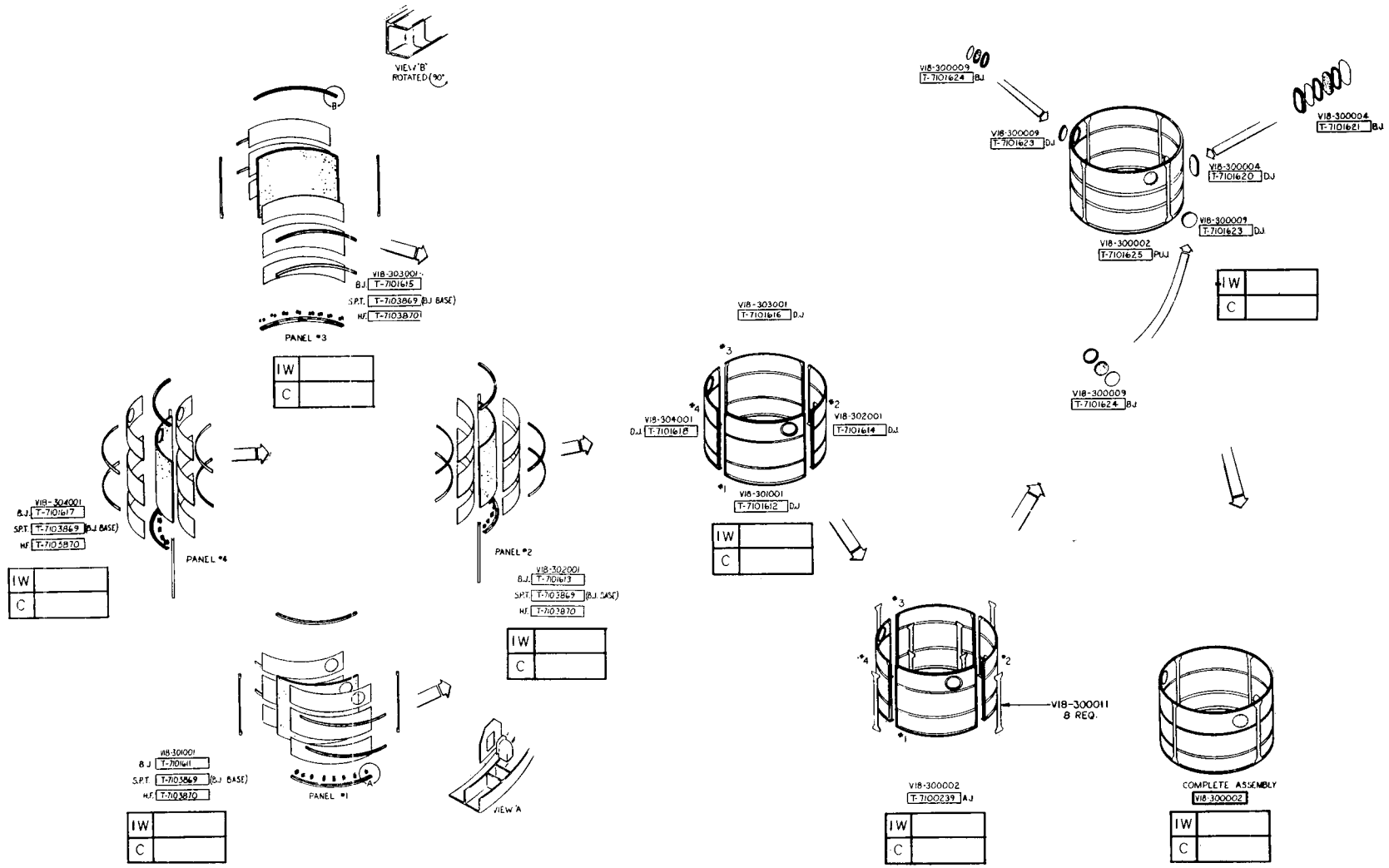
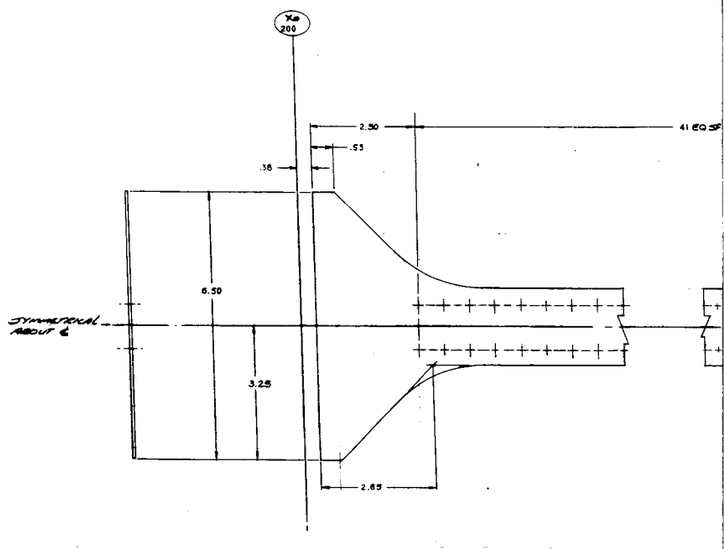


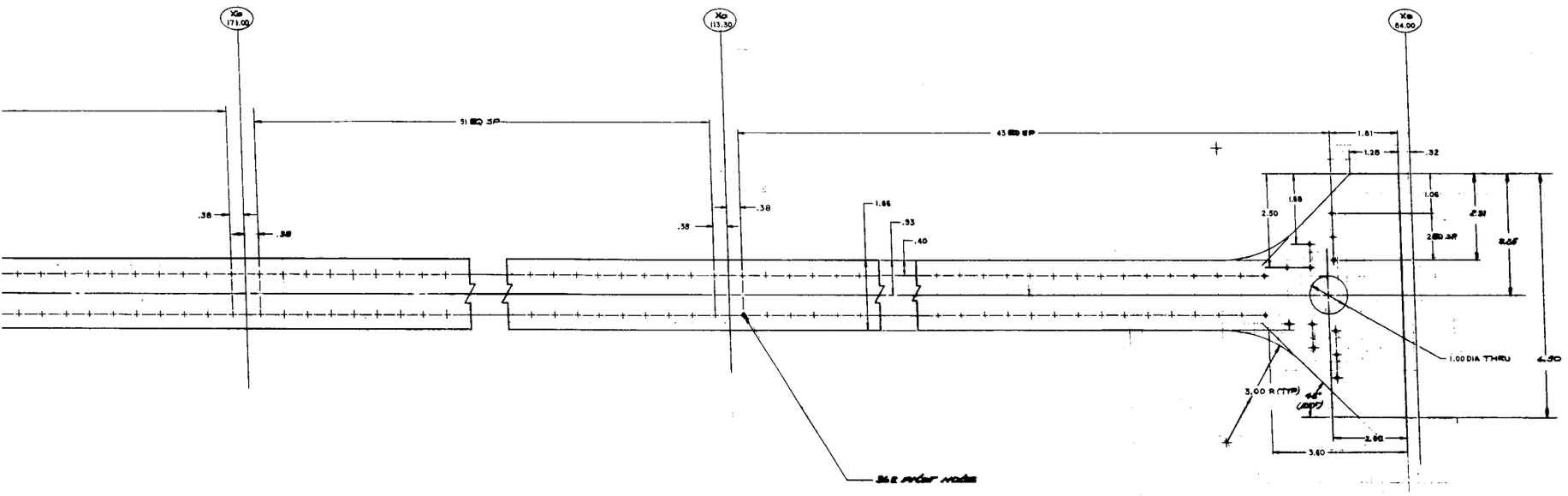
Figure 3-3. Manufacturing Assembly Breakdown of S-1 Adapter (SK015129)

12 11 10 9



12 11 10 9

2


Xe 171.00
Xe 113.30
Xe 84.00
.38
.38
.38
.38
1.66
.93
.40
1.81
1.28
.32
2.50
1.88
1.06
2.38
2.88
4.50
1.00 DIA THRU
3.00 R (TYP)
2.66
3.60

3

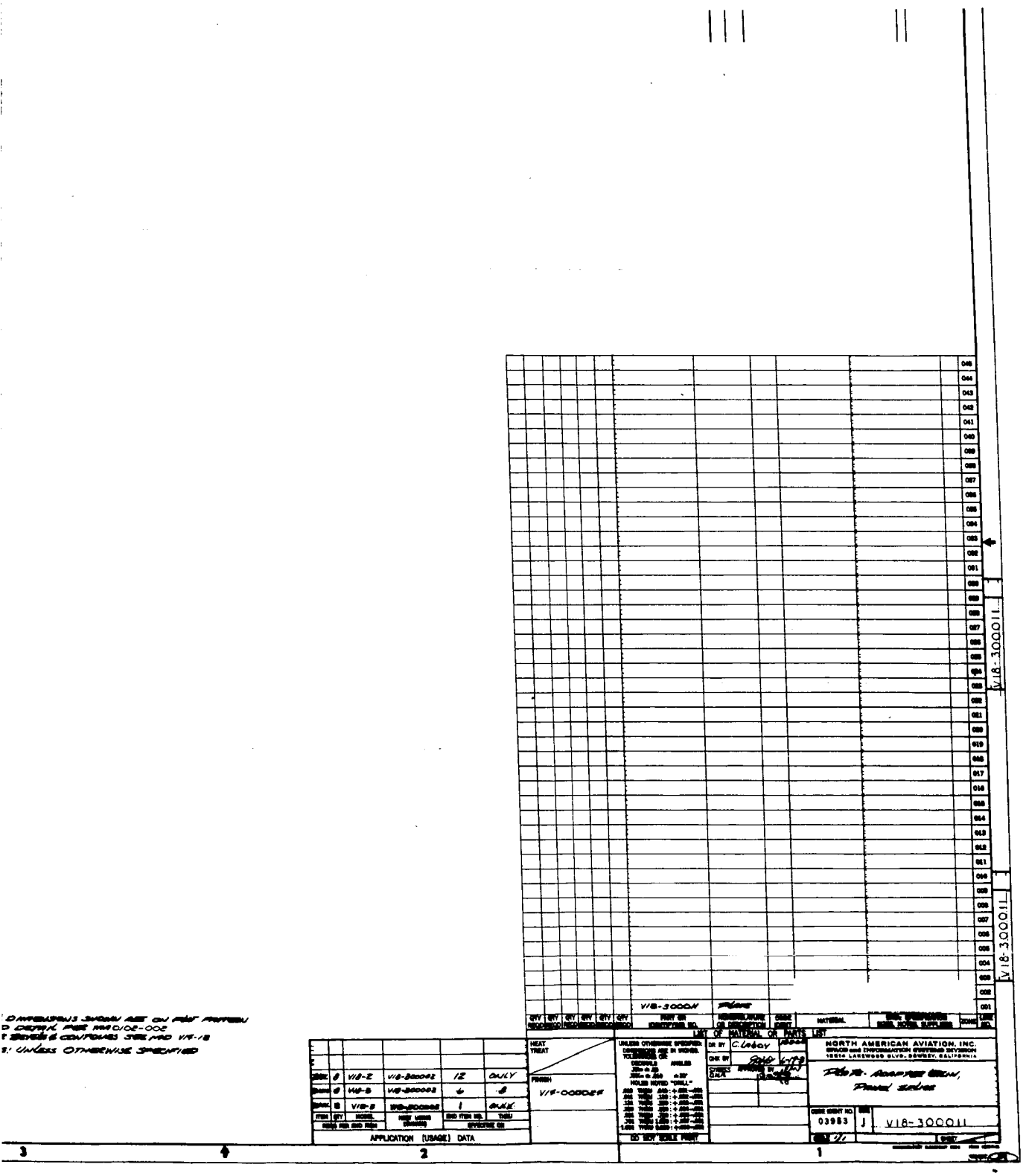


Figure 3-4. Skin Panel Splice for Adapter Plate (V18-300011)

a) to protect the equipment noted in 3.1.2 and 3.1.4 from the effects of environmental forces; b) to distribute the body loads in both C/M and S/M; c) to distribute the S/C loading to the booster.

3.2.4 The support structure for the LEM is also one component of the S-5 adapter, but the present configuration is still in the design stage.

3.3 Operating Conditions

3.3.1 In normal launch and abort missions, the S-1 adapter structure will function until the adapter panels are separated from the S/C by explosive charges to allow SPS-engine operation.

3.3.2 In normal launch and abort of the spacecraft LEM adapter, only the portion above the LEM attach points is separated by explosive charges into four hinged panels. The latter open out to permit the removal of the LEM which withdraws from the booster and leaves it behind.

3.3.3 No detrimental dynamic pressures nor structural shrapnel will be permitted to strike the aft face at Station XS 200 or any equipment within the confines of the adapters.

3.4 Design Characteristics and Criteria - Component Design

3.4.1 Criteria used to complete the design of the adapter components are found in the ARM-6.

3.4.2 Environmental requirements for the adapters are identical to those for the S/M structure. Details are given in 2.4.1.

3.5 Test Requirements

3.5.1 Test requirements for the S-1 adapter components are specifically stated in SID 62-109-2, "General Test Plan, Research and Development for Project Apollo Spacecraft - Individual System Test."

3.5.2 Tests completed and covered by released ATR's are these:

ATR NO.	NAME OF TEST
301-7	Joint - S/M to Adapter
401-1	Circumferential Shear and Tension Splice
401-2	Longitudinal Panel Splice

3.5.3 The following tests have been scheduled but have not been completed:

ATR NO.	NAME OF TEST
400	Spacecraft Adapter Static Test
401	Adapter Structural Test

3.5.4 Those who are not on the ATR distribution list and who have need to know the content of the reports listed above are asked to contact the responsible coordinator.

4.0 SERVICE PROPULSION SYSTEM - TANK STRUCTURES

4.1 General

4.1.1 There are six SPS tanks (two each of three types). They are designed for storage of fuel, oxidizer, and pressurant. The fuel and oxidizer tanks are domed cylinders; the pressurant tanks are spheres. An over-all view of these tanks is found in drawing V17-340001 (Figure 4-1).

4.1.2 The SPS tanks are the only major subcontracted items. Allison, Indianapolis, Indiana is fabricating the fuel and oxidizer tanks. Airite, Los Angeles, California is making the pressurant tanks.

4.1.3 All three pairs of tanks are constructed of titanium alloy (6A1-4V). NAA drawings (See 4.2.1 and 2 below) are used to coordinate and control fabrication processes.

4.1.4 Actual installation of these tanks in the S/M will be governed by Process Specification MA 0310-0007, dated 4 March 1963, and entitled "Fitting and Installation of Apollo SPS Tanks."

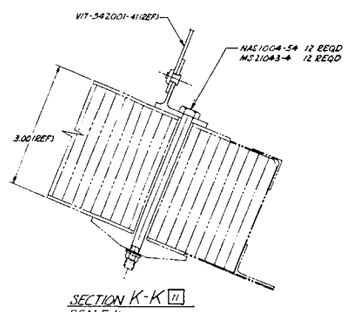
4.2 Configuration and Function

4.2.1 Drawing V17-342001 (Figure 4-2) describes the main oxidizer tank assembly, including the door. Drawing V17-343001 (Figure 4-3) does the same thing for the main fuel tank and its door. Drawings V17-342002 (Figure 4-4) and V17-343002 (Figure 4-5) depict details for fabrication of the oxidizer and fuel tanks, respectively. In the latter two drawings the door is not included.

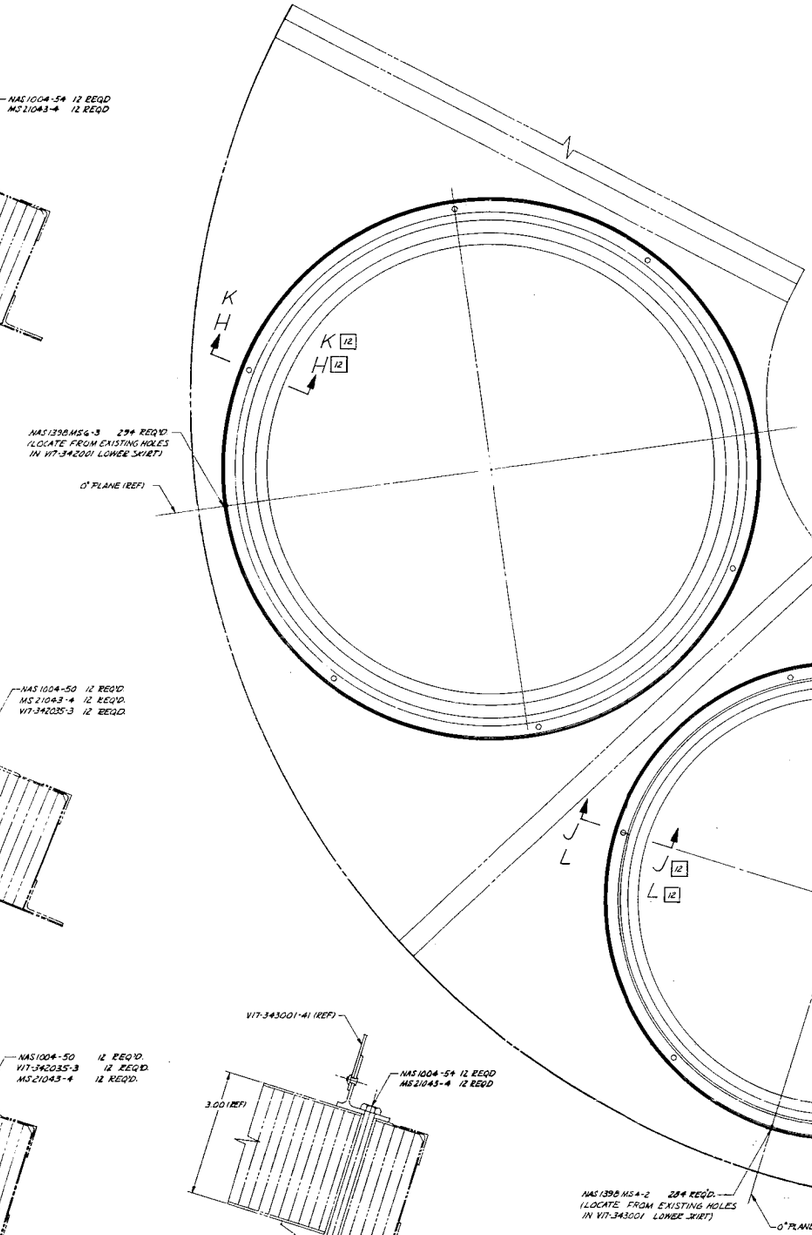
4.2.2 Drawing V17-347002 (Figure 4-6) sets forth fabrication details for the main pressurant tanks.

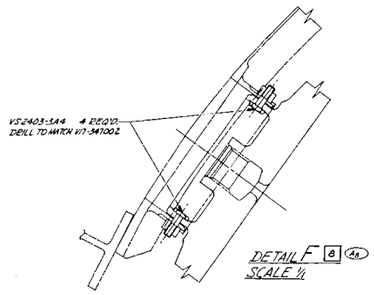
4.2.3 These six tanks of the SPS function as the storage and provision vessels for the fuel and oxidizing agent which under pressurization feed the main SPS engine.

4.2.4 The approximate outside diameter of each fuel tank is 45 inches; of each oxidizer tank, 51 inches. The lengths of these two tanks vary between 166 and 168 inches. The diametric difference between them, coupled with their almost equal length, make for dissimilarity in both weight and volumetric capacity. If one omits the weight of the tank doors and the internal structures, then the weight of the fuel tank is 230 pounds and of the oxidizer tank, 290 pounds. The volumetric capacity of the fuel tank is 140 cubic feet and of the oxidizer tank, 175 cubic feet.

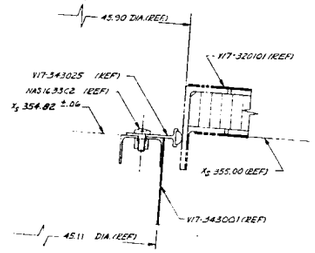


SECTION K-K [11]
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FOR -11 ONLY

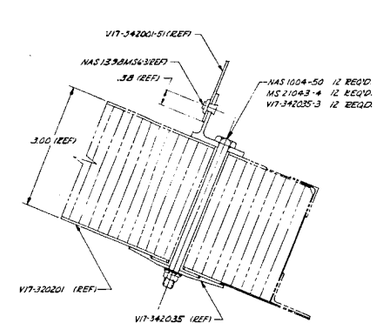




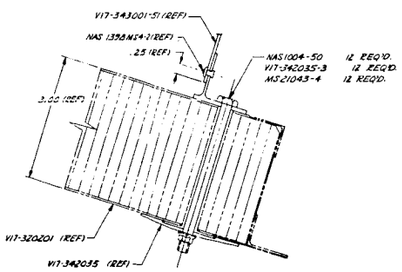
DETAIL F [8] (4a)
SCALE 1/1



SECTION C-C [5]
SCALE 1/1



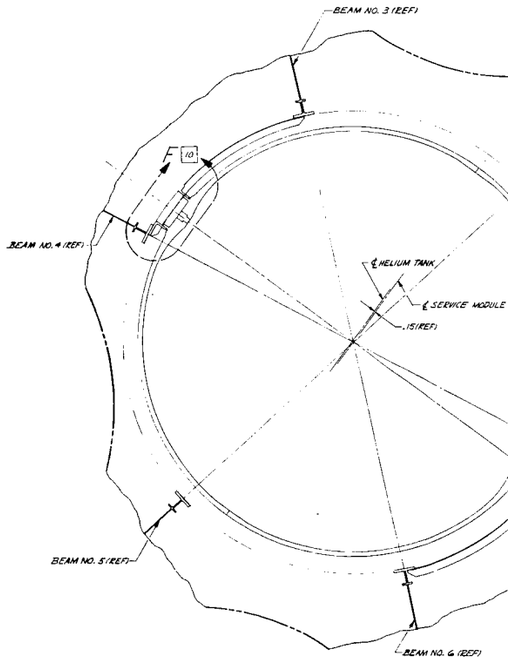
SECTION H-H [11]
SCALE 1/1
FOR BASIC ONLY



SECTION J-J [10]
SCALE 1/1
FOR BASIC ONLY

SECTION L-L [10]
SCALE 1/1
FOR -11 ONLY

SECTION G-G [4]
SCALE 1/4



SECTION D-D [4]
SCALE 1/4

2

51.90 DIA (REF)

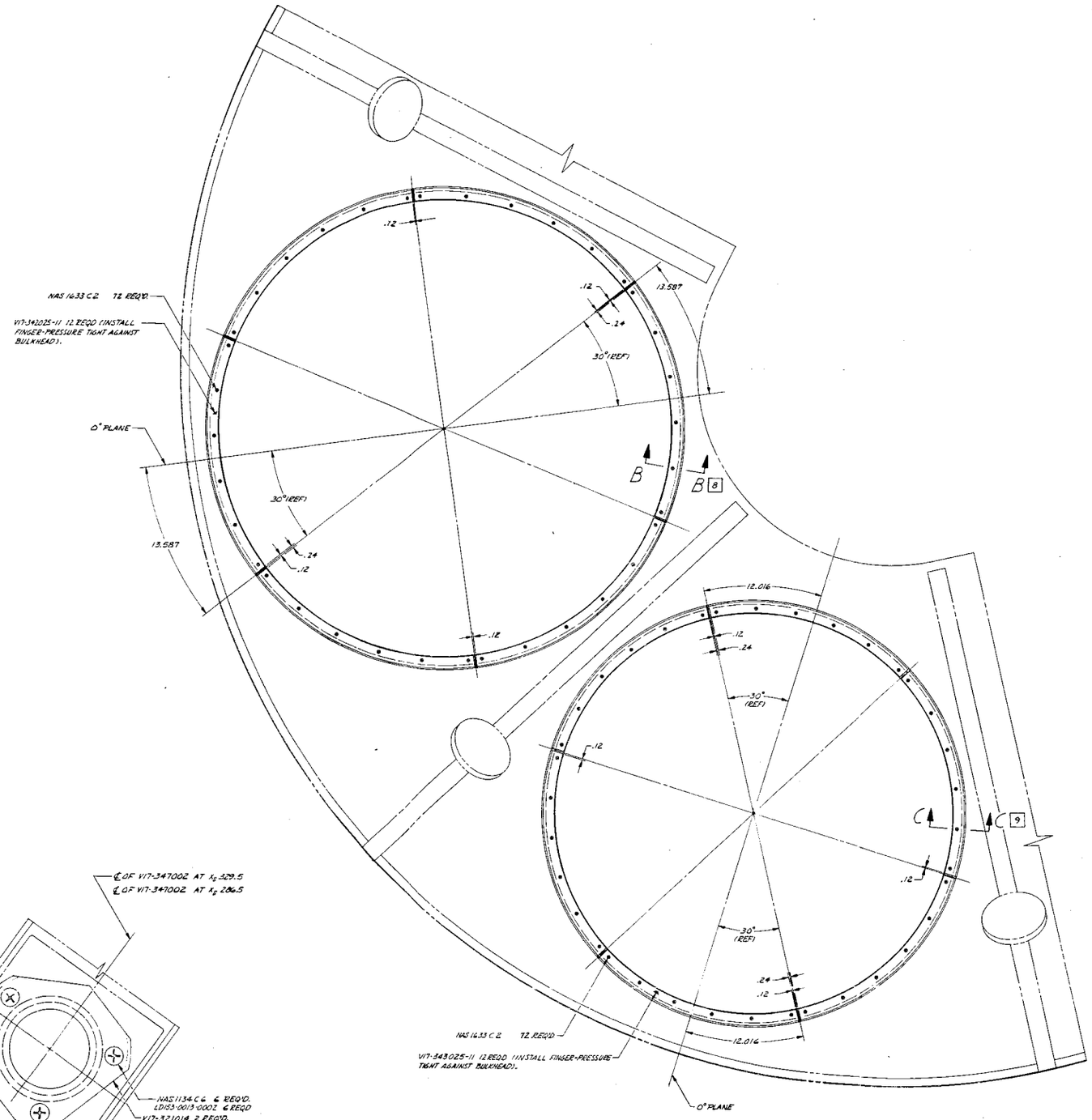
VI7-320101 (REF)

X_s 355.00 (REF)

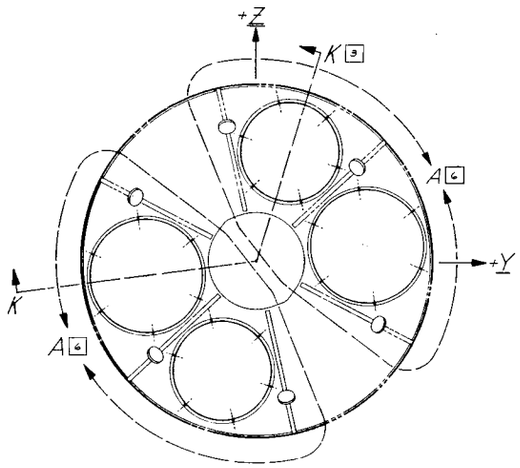
VI7-342001 (REF)

ON B-B 6

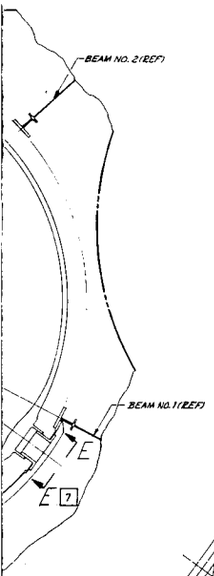
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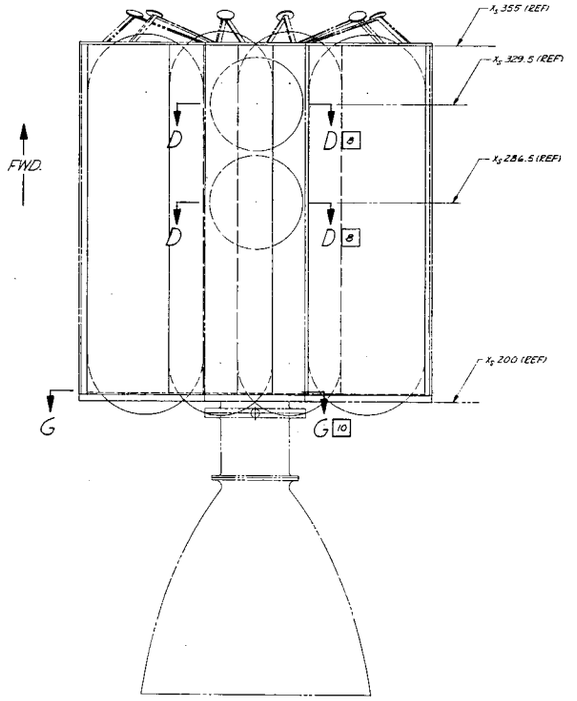
DETAIL A 4
SCALE 1/8



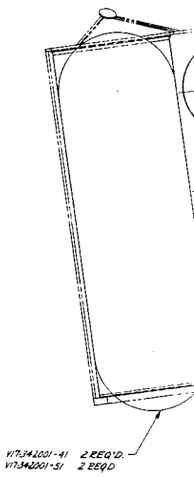
VIEW LOOKING AFT
SCALE 1/20



VIEW E-E 8
SCALE 1/1



SCALE 1/20



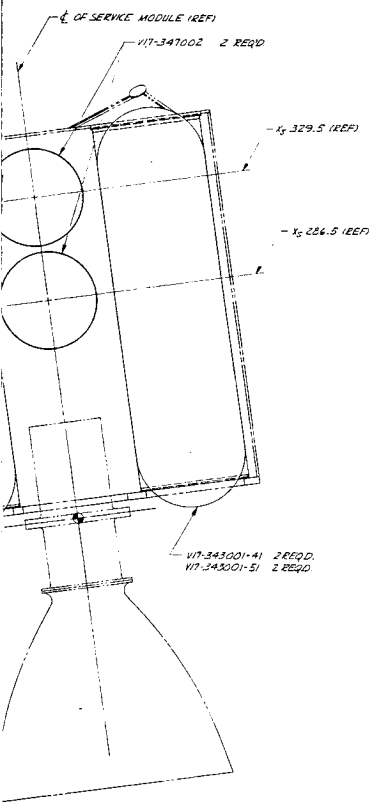
℄ THE SIX HOLES FOR TEMPORARY ATTACHIN
MAY BE LEFT OPEN AFTER INSTALLATION
℄ IN R16 POSITION, 0° PLANE WILL PASS TH
OF TANK & THE CENTER LINE OF SERVIC
4. INSTALL RIVETS PER LA0101-0004.
(1) 3. VOI-SHAN CO., CULVER CITY, CALIFOR
2. INSTALL SERVICE MAIN PROPELLANT
TANKS (VI7-342001, VI7-343001, & VI7-347002
1. INSTALL FASTENERS PER MA0101-005.

NOTES: UNLESS OTHERWISE SPECIFIED;

VI7-340001

Fi

3



SECTION K-K
SCALE 1/20

TRACEABILITY SYMBOLS	
E	TRACEABILITY NOT REQUIRED
T_S	TRACEABILITY BY SERIAL NUMBER — MA0201-0108 OR MA0201-0209
T_L	TRACEABILITY BY LOT NUMBER

REVISIONS

SYM	ZONE	DESCRIPTION	DATE	APPROVED
		1. MAY BE REWORKED 3. RECORD CHANGE 2. CANNOT BE REWORKED 4. NOW SHOP PRACTICE 5. PARTS MADE ON		
A	LMI 6,7, 10 12	1. DELETED LD112-0011-0103, & LD112-0011-0104 TO EACH BEND, MS20208 MS142 284 REQD & MS206-3MS142 568 REQD. ADDED NAS1633C2, 144 REQD, NAS 1398MS6-3, 294 REQD, & LD153-0013-0002, 6 REQD, & NAS1398MS4-2 284 REQD.	1	
		2. ADDED G/N 5, 6, & 7	3	
		3. ADDED EFFECTIVITY IN APPLICATION BLOCK	3	
		4. G/N 2, SPEC WAS MA0310-0100 G/N 3 ADDED MA0310-0107	3	
	6	5. DET A, REMOVED HOIST HOLES & CSK FOR FASTENERS IN V17-342025 & V17-343025	5	
	7	6. VIEW 'E-E' WAS ℄ OF HELIUM TANK AT X_S 329.5, & ℄ OF HELIUM TANK AT X_S 286.5	3	
	8	7. SECTIONS B-B & C-C, CHANGED FIXTURE TO REFLECT SECT. HANDLE IN V17-342002 & V17-343002	3	
	10	8. DET F, CHANGED FIXTURE TO REFLECT CHANGE IN V17-347002.	8	
	10 12	9. SECTIONS G-G, H-H & J-J, CHANGED FIXTURE TO REFLECT CHANGES IN DETAIL.	3	
	9 9	10. SECTIONS D-D & E-E: REMOVED 10-51199-3-5 14# REQD. AN-11199-3-4 44 REQD. ADDED MS 21426 198 REQD.	5	
		11. REMOVED LD153-0002-2404 12 REQD. ADDED V17-343025 24 REQD. EFFECT ON: ITEMS 1 & 11, END ITEM 12, 4, & 7 ITEM 5,	1	DES. STACK 4-25-63
B		1. REVISED PART NUMBER & ADDED - 1 REQ'D 2. DELETED P/N 'ZEUS' SEE LD304-0013 SHEET 2 DO NOT SUPERSESSION ITEM 1 RECOMMENDED 3. ADDED 'S' TO MODEL RIVET CALL OUT 4. DET F, ADDED CELL TO MATCH V17-347002 5. ADDED TRACE SYMBOL BLOCK E.I.R. 9-7-63	2 2 1 1 1	7-13-64 VMS DES. STACK 9-22-63

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT	MATERIAL		DATA: SPECIFICATION SIZES, NOTES, SUPPLIERS	ZONE	LINE NO.
				4	4	VS 2403-3A6	BOLT			E			019
				6	6	LD153-0013-0002	WASHER			E			018
				144	144	NAS1633C2	SCREW			E		10	017
				294	294	NAS1398MS6-3	BLIND RIVET			E		7	016
				284	284	NAS 1398 MS4-2	BLIND RIVET			E		6,7	015
				6	6	NAS1134C6	BOLT			E		11	014
				24		NAS1004-54	BOLT			E		10	013
					24	NAS1004-50	BOLT			E		7	012
				24	24	M.S.21043-4	NUT			E		12	011
				2	2	V17-347002	HELIUM TANK			T_S		8,9	010
				12	12	V17-343025-11	SUPPORT			T_L		12	009
					2	V17-343001-51	TANK ASSEMBLY FUEL			T_S		2	008
				2		V17-343001-41	TANK ASSEMBLY FUEL			T_S		6	007
					24	V17-342035-3	WASHER			E		2	006
				12	12	V17-342025-11	SUPPORT			T_L		12	005
					2	V17-342001-51	TANK ASSEMBLY OXIDIZER			T_S		7	004
				2		V17-342001-41	TANK ASSEMBLY OXIDIZER			T_S		3	003
				2	2	V17-321014	COLLAR			E		7	002
				-11	BASIC	V17-340001	INSTALLATION			T_S			001

LIST OF MATERIAL OR PARTS LIST

V17-340001

ITEM	QTY	MODEL	NEXT USING DRAWING	END ITEM NO.	THRU
-11	1	V17-3	V17-000002	2,3,30,31,32, 34	37
-11	1	V17-3	V17-000002	16,17,18,20, 21,24,25,27,	—
-11	1	V17-3	V17-000002	2,5,6,7, 12	14
SPEC	1	V17-3	V17-000002	1	ONLY

REQD PER END ITEM — EFFECTIVE ON

APPLICATION (USAGE) DATA

HEAT TREAT

FINISH V14-000024

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ON: DECIMALS .XX ± .03, .XXX ± .010; ANGLES ± 30'. HOLES NOTED "DRILL" .018 THRU .040 +.001 -.001, .041 THRU .130 +.002 -.001, .131 THRU .229 +.003 -.001, .230 THRU .500 +.004 -.001, .501 THRU .750 +.005 -.001, .751 THRU 1.000 +.007 -.001, 1.001 THRU 2.000 +.010 -.001

DO NOT SCALE PRINT

DR BY D.E. STACK 2-5-63
CHK BY
3-4-63 APPROVED BY

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

TANK INSTALLATION-MAIN PROPELLANT, SERVICE MODULE

CODE IDENT NO. 03953 SIZE J V17-340001

SCALE 8 of 4 (1/2) SHEET

PANTOGRAPH-POST ELECTRONIC VIDEO

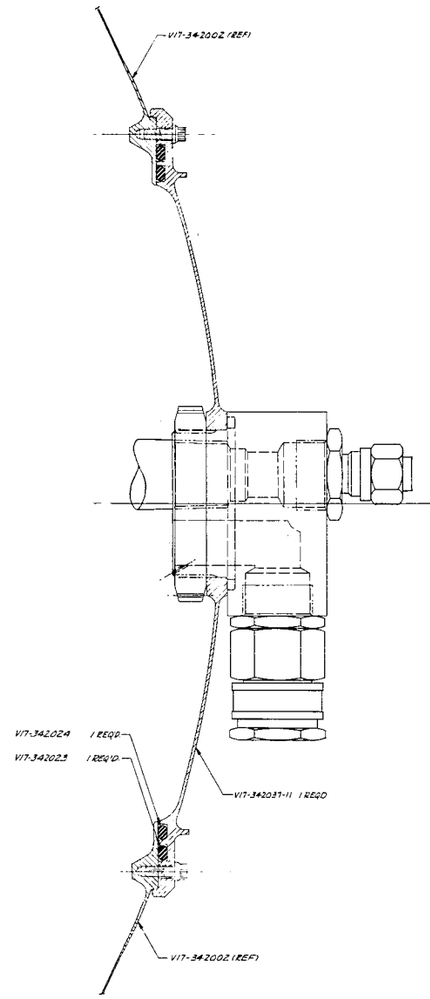
(1) HF

NT OF LOWER SKIRT TO RING
C PERMANENT FASTENERS.
OUGH THE CENTER LINE
MODULE.

1/4.
SERVICE MODULE
EE PROCESS SPEC MA0310-0007.

2 1

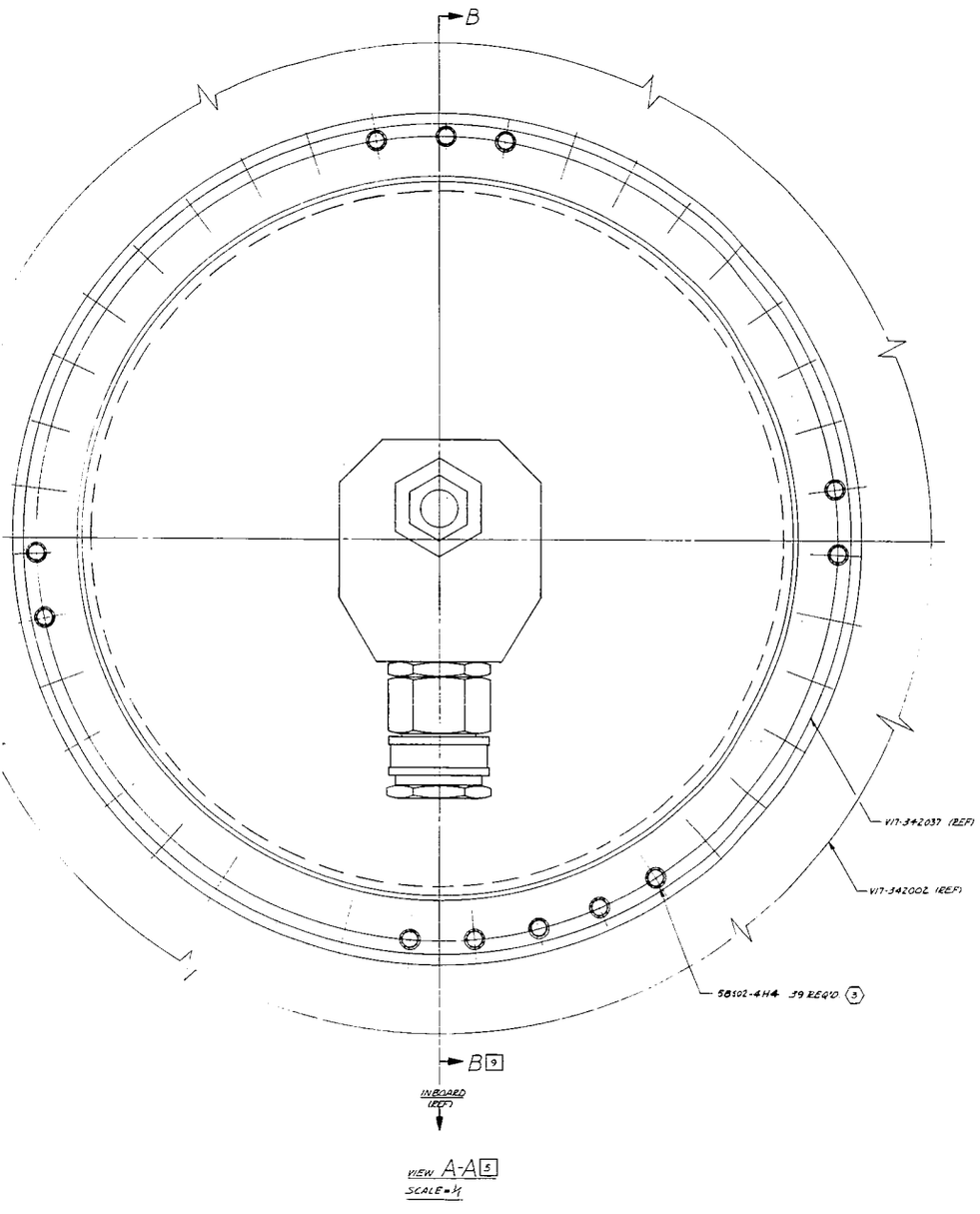
Figure 4-1. Installation of Main Propellant Tank, Service Module (V17-340001)

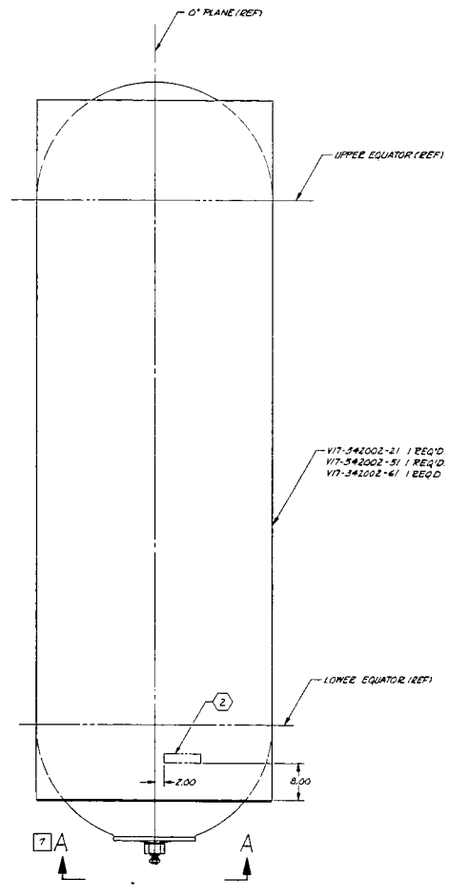


SECTION B-B
SCALE = 1/1

V17-342001

2





10. FOR PURPOSES OF SPARES -41 CAN BE USED IN PLACE OF -51 C
(3) 9. SEQUENCE OF BOLT TIGHTENING TO BE APPROVED BY EN
8. QUALIFICATION & ACCEPTANCE TESTS SHALL BE
7. TORQUE BOLTS TO 60-80 IN LB PER MA0101-0
6. INSTALL THREADED FASTENERS & SAFETY WIR

(1) 5. INTERIOR & EXTERIOR SURFACES ARE NOT TO
CHEMICALLY TREATED FOR PRESERVATION & SHA
BLEMISHES, NICKS, SCRATCHES OR OTHER IMP

(2) 4. IDENTIFY PER LA0124-003, INCLUDING SERIALIZAT
CHEMICAL ETCHING, PARAGRAPH 4.3.6.
3. IN RIG POSITION 0° PLANE WILL PASS THRU
SERVICE MODULE.
2. PACKAGING OF THE TANK SHALL BE PER M
1. CLEANING SHALL BE ACCOMPLISHED AFTER
EXCEPT CLEANLINESS TESTS HAVE BEEN CO
OF MA0610-004 SHALL BE MET.
NOTES: UNLESS OTHERWISE SPECIFIED

V17-342001 SHT 2

7 6 5 4 3

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION

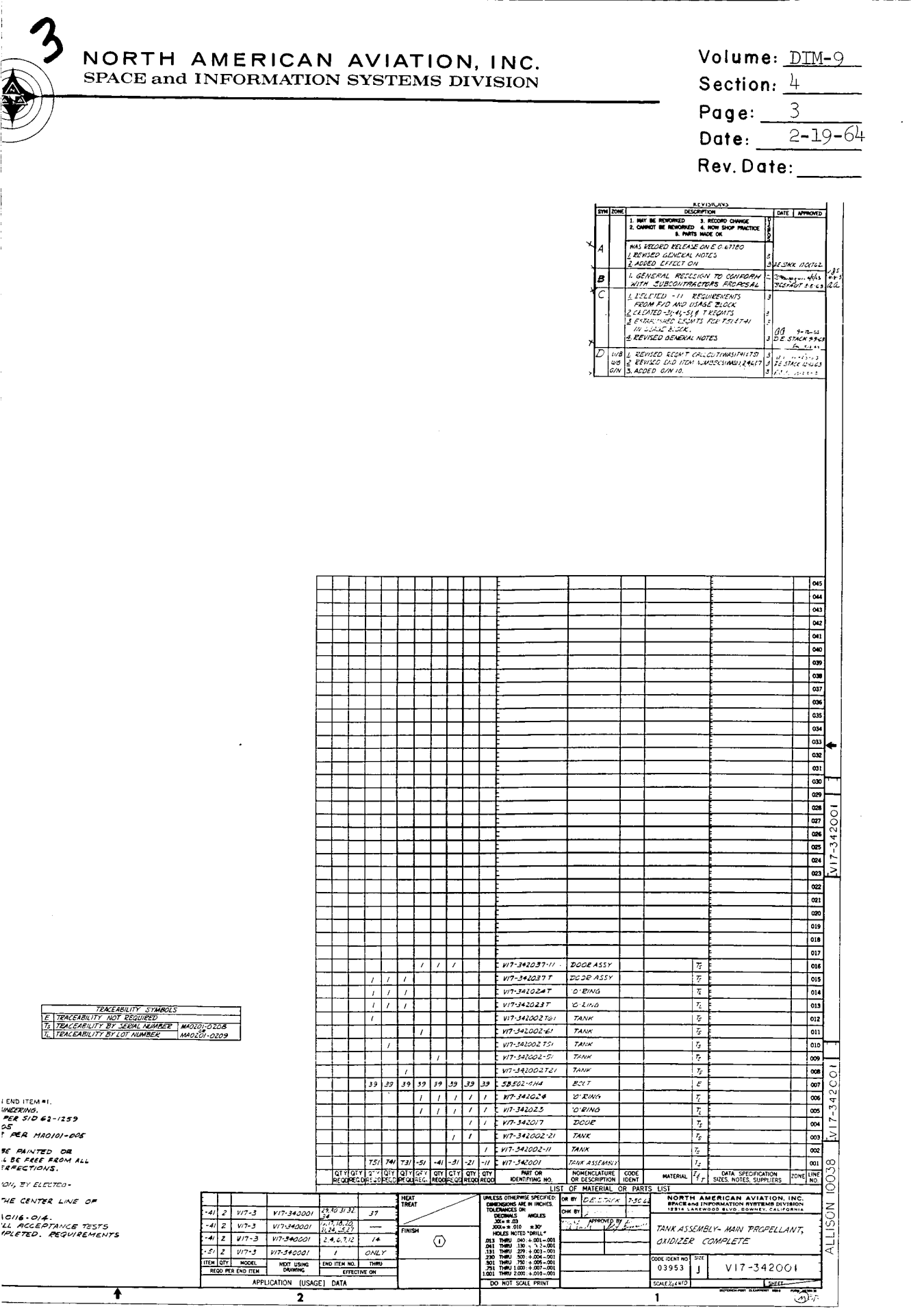
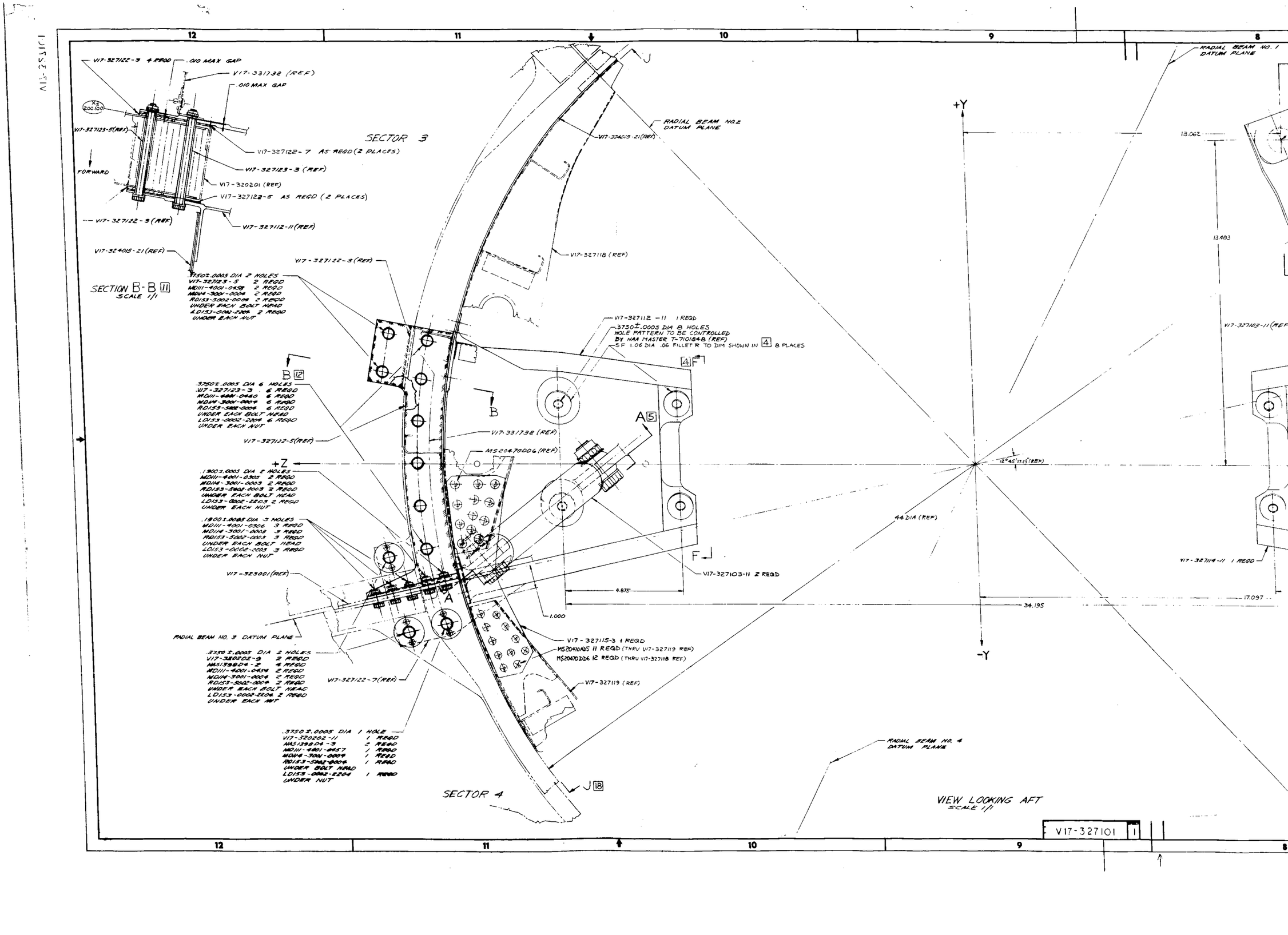


Figure 4-2. Tank Assembly Complete: Main Propellant, Oxidizer (V17-342001)


SECTOR 3
SECTOR 4
SECTION B-B [11]
SCALE 1/1
VIEW LOOKING AFT
SCALE 1/1
FORWARD
V17-327122-3 4 REQD
.010 MAX GAP
V17-331732 (REF)
V17-327123-5(REF)
V17-327122-7 AS REQD (2 PLACES)
V17-327123-3 (REF)
V17-320201 (REF)
V17-327122-5 AS REQD (2 PLACES)
V17-327122-9 (REF)
V17-327112-11(REF)
V17-324015-21(REF)
.3750±.0005 DIA 2 HOLES
V17-327123-5 2 REQD
MD111-4001-0438 2 REQD
MD114-3001-0004 2 REQD
RD153-5002-1008 2 REQD
UNDER EACH BOLT HEAD
LD153-0002-2208 2 REQD
UNDER EACH NUT
V17-327122-3(REF)
V17-327118 (REF)
V17-327112-11 1 REQD
.3750±.0005 DIA 8 HOLES
HOLE PATTERN TO BE CONTROLLED
BY NAA MASTER T-7101848 (REF)
S.F. 1.06 DIA .06 FILLET R TO DIM SHOWN IN [4] 8 PLACES
B [12]
.3750±.0005 DIA 6 HOLES
V17-327123-3 6 REQD
MD111-4001-0440 6 REQD
MD114-3001-0004 6 REQD
RD153-5002-1008 6 REQD
UNDER EACH BOLT HEAD
LD153-0002-2208 6 REQD
UNDER EACH NUT
V17-327122-5(REF)
V17-331732 (REF)
MS20470DD6(REF)
+Z
.1900±.0005 DIA 2 HOLES
MD111-4001-0305 2 REQD
MD114-3001-0003 2 REQD
RD153-5002-0003 2 REQD
UNDER EACH BOLT HEAD
LD153-0002-2203 2 REQD
UNDER EACH NUT
.1900±.0005 DIA 3 HOLES
MD111-4001-0306 3 REQD
MD114-3001-0003 3 REQD
RD153-5002-0003 3 REQD
UNDER EACH BOLT HEAD
LD153-0002-2203 3 REQD
UNDER EACH NUT
V17-323001(REF)
RADIAL BEAM NO. 3 DATUM PLANE
.3750±.0005 DIA 2 HOLES
V17-320202-9 2 REQD
NAS1398D4-2 4 REQD
MD111-4001-0434 2 REQD
MD114-3001-0004 2 REQD
RD153-5002-0004 2 REQD
UNDER EACH BOLT HEAD
LD153-0002-2204 2 REQD
UNDER EACH NUT
V17-327122-7(REF)
.3750±.0005 DIA 1 HOLE
V17-320202-11 1 REQD
NAS1398D4-3 1 REQD
MD111-4001-0457 1 REQD
MD114-3001-0009 1 REQD
RD153-5002-0004 1 REQD
UNDER BOLT HEAD
LD153-0002-2204 1 REQD
UNDER NUT
RADIAL BEAM NO.2 DATUM PLANE
V17-324015-21(REF)
V17-327103-11 2 REQD
4.875
1.000
V17-327115-3 1 REQD
MS20470AD5 11 REQD (THRU V17-327119 REF)
MS20470DD6 12 REQD (THRU V17-327118 REF)
V17-327119 (REF)
RADIAL BEAM NO. 4 DATUM PLANE
+Y
-Y
13.062
13.483
72°45'17.25"(REF)
44 DIA (REF)
34.195
17.097
V17-327103-11(REF)
V17-327114-11 1 REQD
RADIAL BEAM NO. 1 DATUM PLANE

2

SECTOR 1

SECTOR 6

POINT W (SEE ZONE 22)

V17-327108-11 1 REQD

V17-327106-3 1 REQD
MS20470AD5 11 REQD (THRU V17-327119 REF)
MS20470D6 12 REQD (THRU V17-327118 (REF)

V17-320201(REF)

.3750±.0005 DIA 1 HOLE
V17-320202-11 1 REQD
NAS1398D4-3 2 REQD
MD111-4001-0457 1 REQD
MD114-3001-0004 1 REQD
RD153-3002-0004 1 REQD
UNDER BOLT HEAD
LD153-0002-2204 1 REQD
UNDER NUT

V17-327119(REF)

.3750±.0005 DIA 2 HOLES
V17-320202-9 2 REQD
NAS1398D4-2 4 REQD
MD111-4001-0454 2 REQD
MD114-3001-0004 2 REQD
RD153-3002-0004 2 REQD
UNDER EACH BOLT HEAD
LD153-0002-2204 2 REQD
UNDER EACH NUT

RADIAL BEAM NO. 6 DATUM PLANE

V17-326001(REF)

.3750±.0005 DIA 6 HOLES
V17-327123-3 6 REQD
MD111-4001-0460 6 REQD
MD114-3001-0004 6 REQD
RD153-5002-0004 6 REQD
UNDER EACH BOLT HEAD
LD153-0002-2204 6 REQD
UNDER EACH NUT

V17-327115-3(REF)

V17-327106-3(REF)

MD111-4001-1018 1 REQD
MD114-3001-0010 1 REQD
RD153-5002-0010 1 REQD
UNDER BOLT HEAD
LD153-0010-0021 1 REQD
UNDER NUT

V17-324015-11(REF)

V17-327103-11 (REF)

MD111-4001-1018 1 REQD
MD114-3001-0010 1 REQD
RD153-5002-0010 1 REQD
UNDER BOLT HEAD
LD153-0010-0021 1 REQD
UNDER NUT

V17-327114-11(REF)

SECTION C-C 7
SCALE 1/1

V17-324015-11(REF)

.1900±.0005 DIA 2 HOLES
MD111-4001-0305 2 REQD
MD114-3601-0003 2 REQD
RD153-3002-0003 2 REQD
UNDER EACH BOLT HEAD
LD153-0002-2203 2 REQD
UNDER EACH NUT

.1900±.0005 DIA 3 HOLES
MD111-4001-0306 3 REQD
MD114-3001-0003 3 REQD
RD153-3002-0003 3 REQD
UNDER EACH BOLT HEAD
LD153-0002-2203 3 REQD
UNDER EACH NUT

FORWARD

INBOARD

V17-327122-5(REF)

V17-327114-11(REF)

V17-320231(REF)

V17-327122-7(REF)

SECTION D-D 7
SCALE 1/1

V17-320202-9(REF)

V17-320201(REF)

.010 MAX GAP

V17-327114-11(REF)

V17-327122-7(REF)

SECTION G-G 7
SCALE 1/1

4.500

4° EIC

.780 SPOTFACE TO THIS DIM 8 PLACES

ENTRY GIMBAL OF SPS ENGINE

XZ PLANE

FORWARD

SECTION F-F 10
SCALE 1/1

V17-327118(REF)

V17-324015-11(REF)

V17-331732 (REF)

4.875

SECTION E-E 7
SCALE 1/1

V17-327114-11(REF)

V17-320151-11(REF)

V17-327122-5 (REF)

V17-327123-3(REF)

V17-327122-7(REF)

V17-327122-3 (REF)

V17-327123-5 (REF)

V17-320201(REF)

V17-327122-9(REF)

.010 MAX GAP

.010 MAX GAP

V17-331732 (REF)

RADIAL BEAM NO. 5 DATUM PLANE

SECTION A-A 10
SCALE 1/1

V17-327101 SHEET 1

TRACEABILITY SYMBOLS	
E	TRACEABILITY NOT REQUIRED
T_1	TRACEABILITY BY SERIAL NUMBER (MA0201-0208)
T_2	TRACEABILITY BY LOT NUMBER (MA0201-0208)

E				1	RD	
E				22	RD	
E				10	RD	
E				1	NS	
E				1	AN	
E				16	NS	
E				6	AN	
E				8	AN	
E				2	AN	
E				2	NS	
				VI	VI	
14T	QTY REQ'D	QTY VEH	QTY REQ'D	QTY VEH	QTY REQ'D	

① 3 MAY BE PURCHASED FROM HI SHEAR RIVET TOOL CO, TORRANCE, CALIF.
.. INSTALL THREADED & COLLARED FASTENERS
I. INSTALL RIVETS PER MA910-006
NOTE: UNLESS OTHERWISE SPECIFIED

3

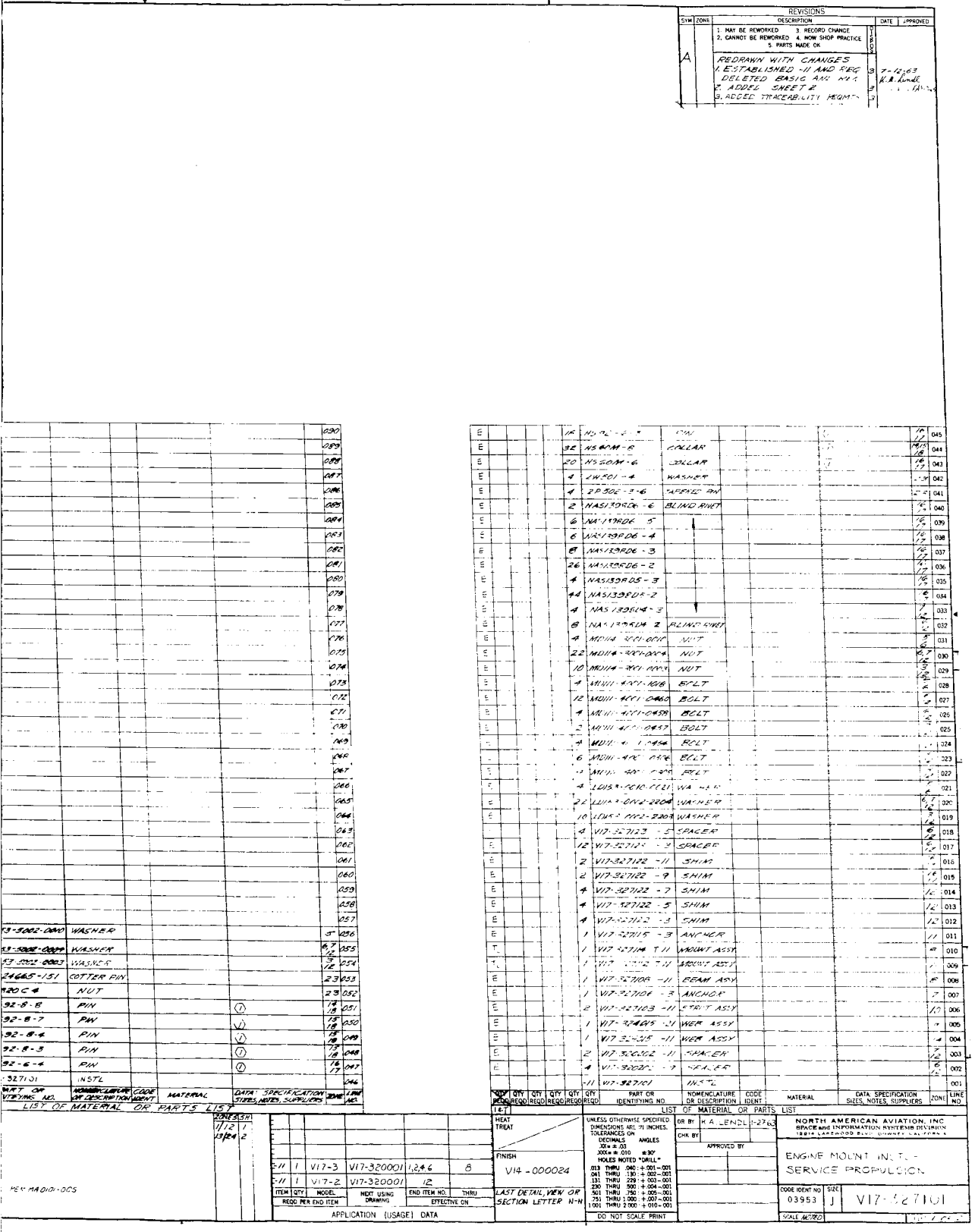
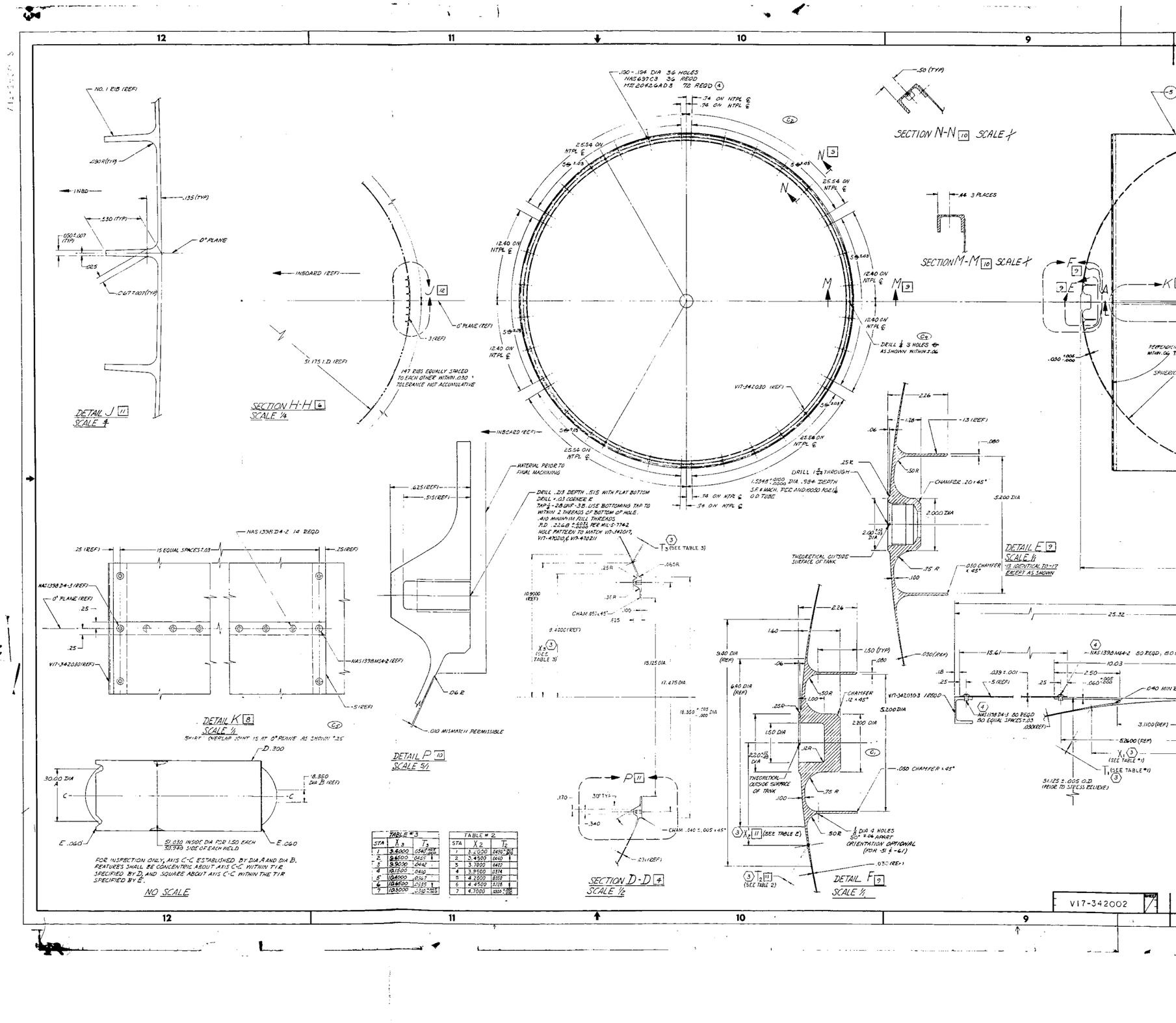
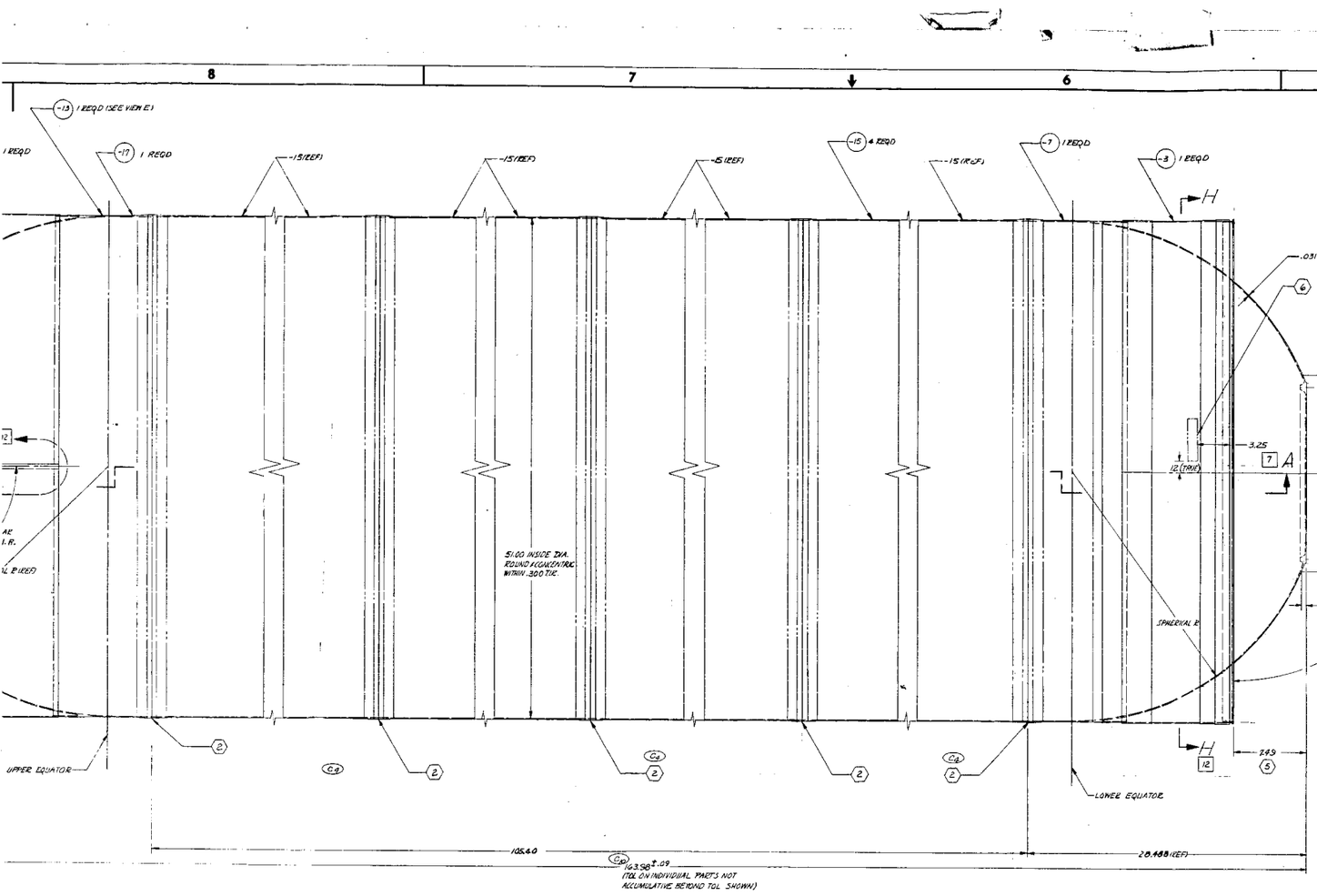
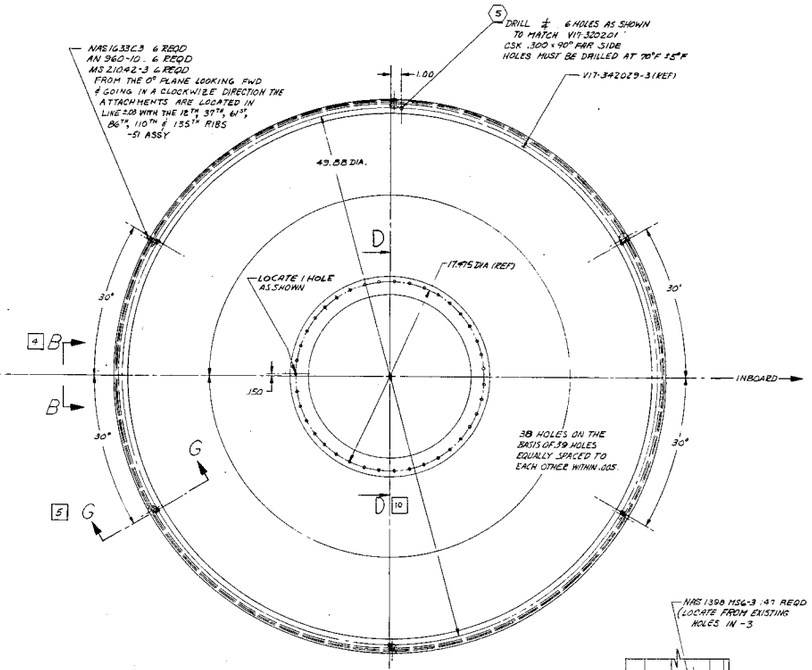


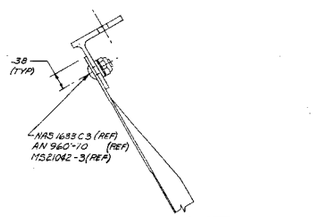
Figure 5-16. Installation of Engine Mount, Service Propulsion System (V17-327101-1)


NO. 1 RIB (REF)
.230R (TYP)
INBD
.135 (TYP)
.530 (TYP)
.050 ±.007 (TYP)
0° PLANE
.025
.067 ±.007 (TYP)
DETAIL J 11
SCALE 4
INBOARD (REF)
0° PLANE (REF)
3 (REF)
51.175 I.D. (REF)
147 RIBS EQUALLY SPACED TO EACH OTHER WITHIN .030 " TOLERANCE NOT ACCUMULATIVE
SECTION H-H 6
SCALE 1/4
.190 - .194 DIA 36 HOLES
NAS697C3 36 REQD
MS20426AD3 72 REQD 4
.74 ON NTPL ℄
.74 ON NTPL ℄
25.54 ON NTPL ℄
12.40 ON NTPL ℄
DRILL 3 HOLES ⌖ AS SHOWN WITHIN .06
VIT-342030 (REF)
INBOARD (REF)
MATERIAL PRIOR TO FINAL MACHINING
DRILL .213 DEPTH .515 WITH FLAT BOTTOM DRILL +.03 CORNER R
TAP 1/4 - 28 UNF - 3B USE BOTTOMING TAP TO WITHIN 2 THREADS OF BOTTOM OF HOLE. .410 MINIMUM FULL THREADS
P.D. .2268 +.0023 -.0000 PER MIL-S-7742
HOLE PATTERN TO MATCH VIT-342011, VIT-470210 & VIT-470211
.625 (REF)
.515 (REF)
.06 R
.010 MISMATCH PERMISSIBLE
DETAIL P 13
SCALE 5/1
.50 (TYP)
SECTION N-N 10 SCALE 1
.44 3 PLACES
SECTION M-M 10 SCALE 1
1.5348 +.0020 -.0000 DIA .984 DEPTH S.F. & MACH. FOR AN INTERFERENCE FIT ON .750 TUBE
2.26
1.28
.06
.13 (REF)
.080
.25 R
.50 R
CHAMFER .20 x 45°
5.200 DIA
2.000 DIA
2.00 +.05 -.03 DIA
.75 R
.100
.050 CHAMFER x 45°
THEORETICAL CUTTING SURFACE OF TANK
DETAIL E 9
SCALE 1/1
(8 IDENTICAL TO -17 EXCEPT AS SHOWN
.030 +.006 -.000
PERPENDICULARITY WITHIN .06 T
SPHERICITY
NAS1398 D4-2 14 REQD
.25 (REF)
15 EQUAL SPACES ±.03
.25 (REF)
NAS1398 D4-3 (REF)
0° PLANE (REF)
.25
.25
VIT-342030 (REF)
NAS1398 M3-2 (REF)
.5 (REF)
DETAIL K 8
SCALE 1/1
SKIRT OVERLAP JOINT IS AT 0° PLANE AS SHOWN *35
D.300
30.00 DIA
C
C
18.850 DIA B (REF)
E .060
51.030 INSIDE DIA FOR 1.50 EACH 30.930 SIDE OF EACH WELD
E .060
FOR INSPECTION ONLY, AXIS C-C ESTABLISHED BY DIA A AND DIA B. FEATURES SHALL BE CONCENTRIC ABOUT AXIS C-C WITHIN T.I.R. SPECIFIED BY D, AND SQUARE ABOUT AXIS C-C WITHIN THE T.I.R. SPECIFIED BY E.
NO SCALE
TABLE # 3
STA | X3 | T3
1 | 5.6000 .0540 +.005 -.000
2 | 6.6000 .0435
3 | 9.9000 .0442
4 | 10.1500 .0419
5 | 10.4000 .0367
6 | 10.6500 .0335
7 | 10.9000 .0310 +.005 -.000
TABLE # 2
STA | X2 | T2
1 | 3.4000 .0490 +.005 -.000
2 | 3.4500 .0440
3 | 3.7000 .0402
4 | 3.9500 .0374
5 | 4.2000 .0353
6 | 4.4500 .0328
7 | 4.7000 .0310 +.005 -.000
(3) T3 (SEE TABLE 3)
.060R
.25 R
.38 R
.100
.625
CHAM .057 x 45°
10.9000 (REF)
8.4200 (REF)
(3) X3 (SEE TABLE 3)
15.125 DIA
17.475 DIA
18.350 +.005 -.000 DIA
SECTION D-D 4
SCALE 1/2
P 11
.170
30° TYP
.340
CHAM .040 ±.005 x 45°
.031 (REF)
2.26
1.60
1.50 (TYP)
.030 (REF)
.06
.080
9.40 DIA (REF)
6.40 DIA (REF)
.50 R
CHAMFER .12 x 45°
5.200 DIA
.25 R
1.50 DIA
2.200 DIA
.12 R
2.00 +.05 -.03 DIA
THEORETICAL CUTTING SURFACE OF TANK
.050 CHAMFER x 45°
.75 R
.100
(3) X2 11 (SEE TABLE 2)
.50 R
1/4 DIA 4 HOLES 90° ± .06 APART ORIENTATION OPTIONAL (FOR -51 & -61)
.030 (REF)
(3) T2 11 (SEE TABLE 2)
DETAIL F 9
SCALE 1/1
25.32
15.61
10.03
.18
.039 ±.001
.25
.5 (REF)
2.50
.060 +.005 -.000
.25
4 NAS1398 D4-3 50 REQD. 50 EQUAL SPACES ±.03
.030 (REF)
.040 MIN E
3.1100 (REF)
52.600 (REF)
X1 3 (SEE TABLE #1)
T1 3 (SEE TABLE #1)
51.125 ±.005 O.D. (PRIOR TO STRESS RELIEVE)
V17-342002
SHEET 1
12
11
10
9

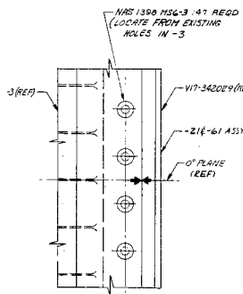
2







SECTION G-G 5 SCALE 4
-51 ASSY ONLY



DETAIL L 3 SCALE 1
IDENTICAL TO "B-B" EXCEPT AS SHOWN

TABLE NO. 1		
STA	X_1	T_1
* 1	3.1100	.0520 +.035 -.000
2	3.3600	.0476
3	3.6100	.0440
4	3.8600	.0410
5	4.1100	.0385
6	4.3600	.0364
7	4.6100	.0344
8	4.8600	.0327
9	5.1100	.0310
10	5.2600	.0300 +.005 -.000 (AS 10 FOR UPPER DOME ONLY)

C6 * STA 1 THEORETICAL THICKNESS ONLY, DUE TO RADIUS OVERLAP

SECTION A-A 9 SCALE 1/1

DETAIL C 6 SCALE 12 3
TYPICAL FOR ALL WELD LANDS AND TRANSITION AREAS IN CYLINDRICAL PORTION OF TANK

VIEW B-B 5 SCALE 1/1

V17-342002 SHEET

8 7 6 5 4

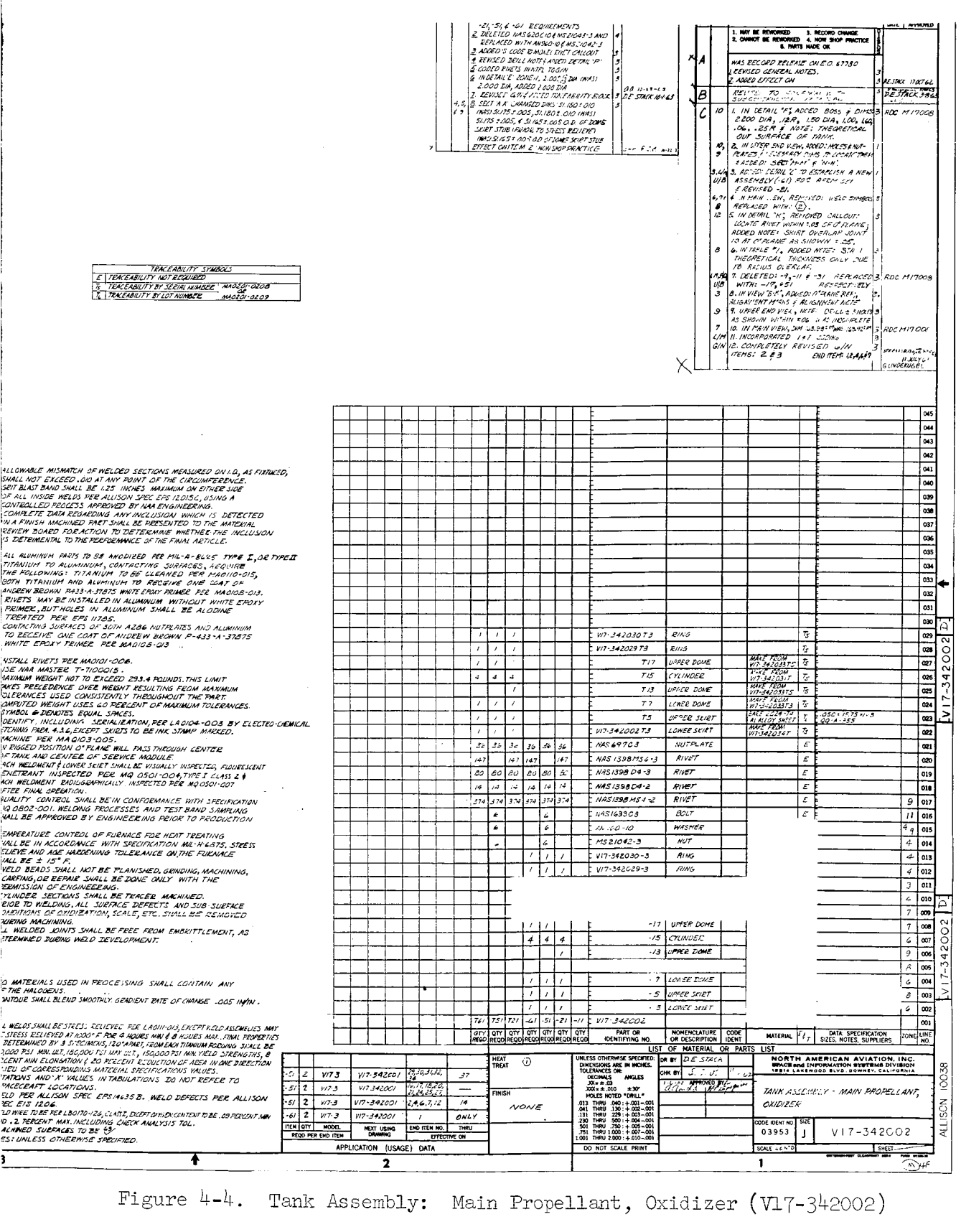


Figure 4-4. Tank Assembly: Main Propellant, Oxidizer (V17-342002)

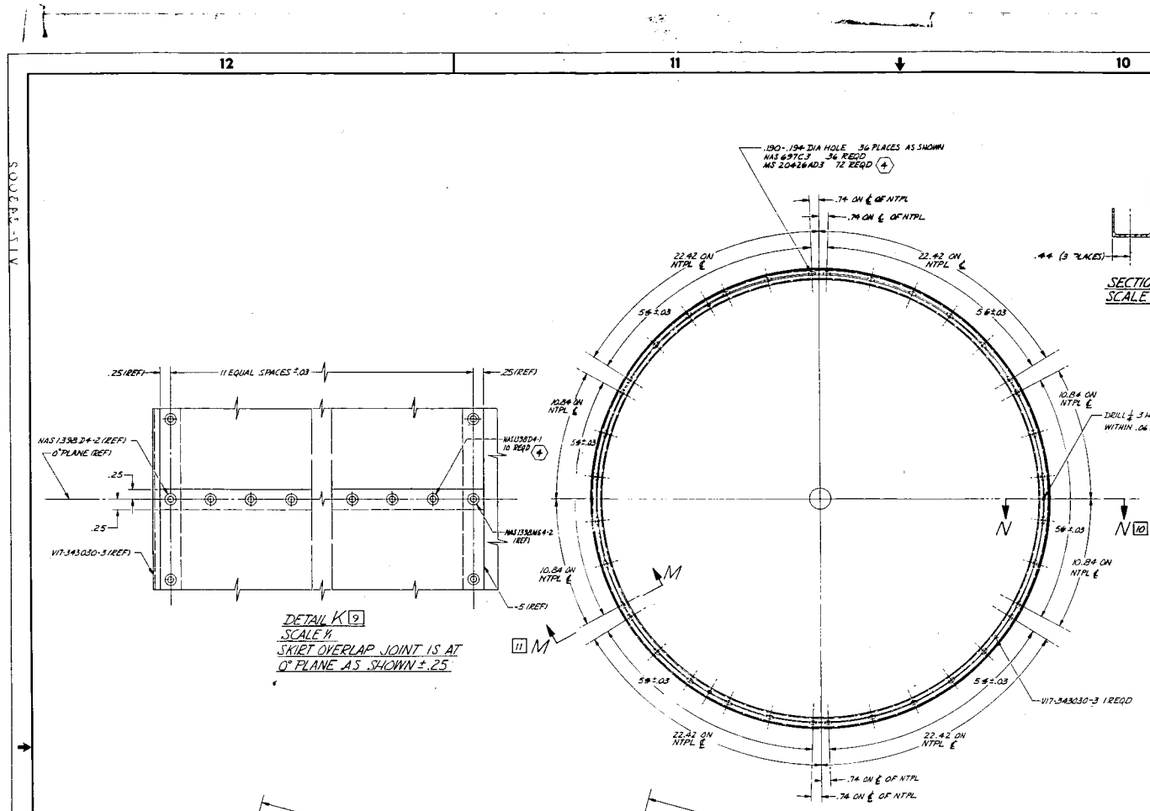


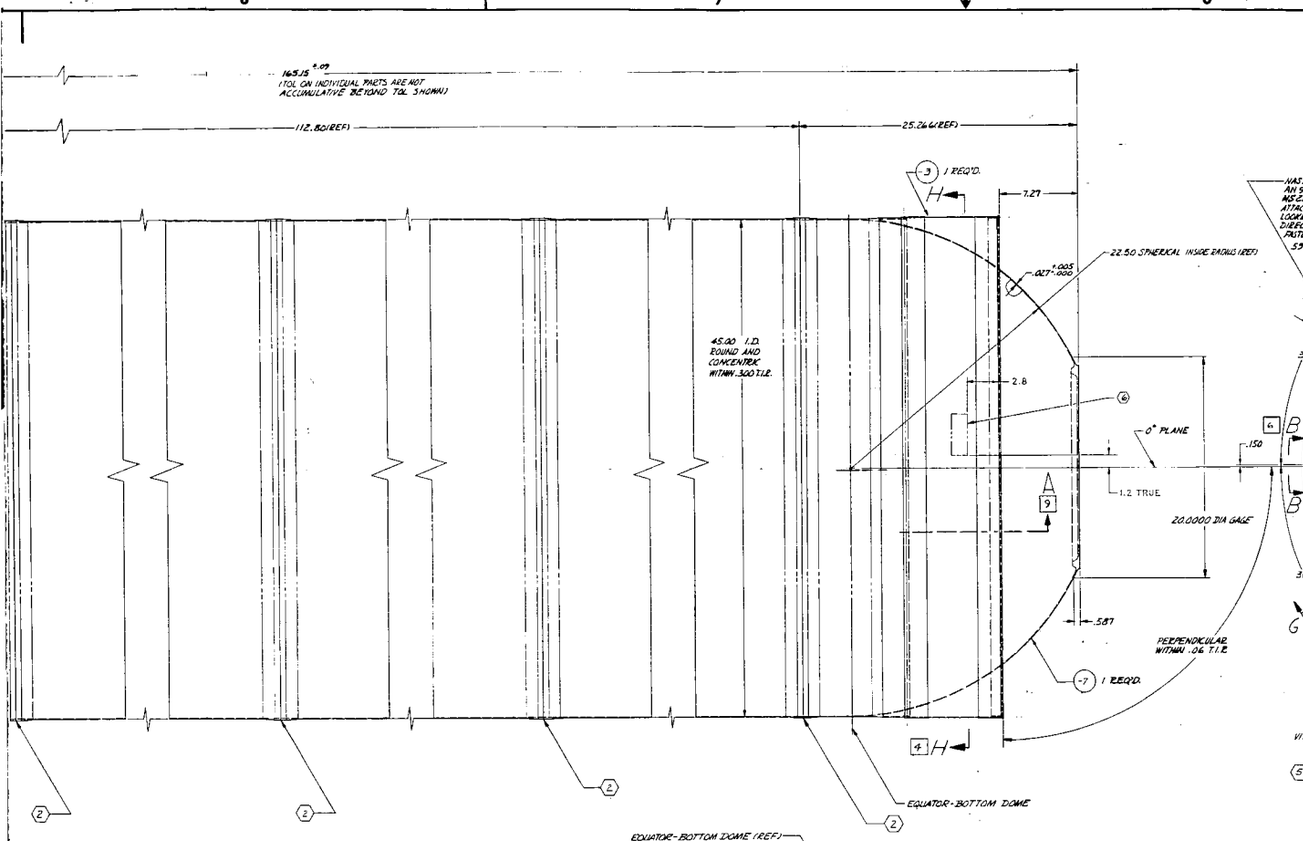
TABLE NO.1		
STA	X_1	T_1
1	2.7700	.0450 +.003 -.003
2	3.0200	.0412 +.003 -.000
3	3.2700	.0391 +.003 -.000
4	3.5200	.0355 +.003 -.000
5*	3.7700	.0334 +.003 -.000
6	4.0200	.0316 +.003 -.000
7	4.2730	.0300 +.003 -.000
8	4.5200	.0294 +.005 -.000
9	4.7700	.0270 +.005 -.000

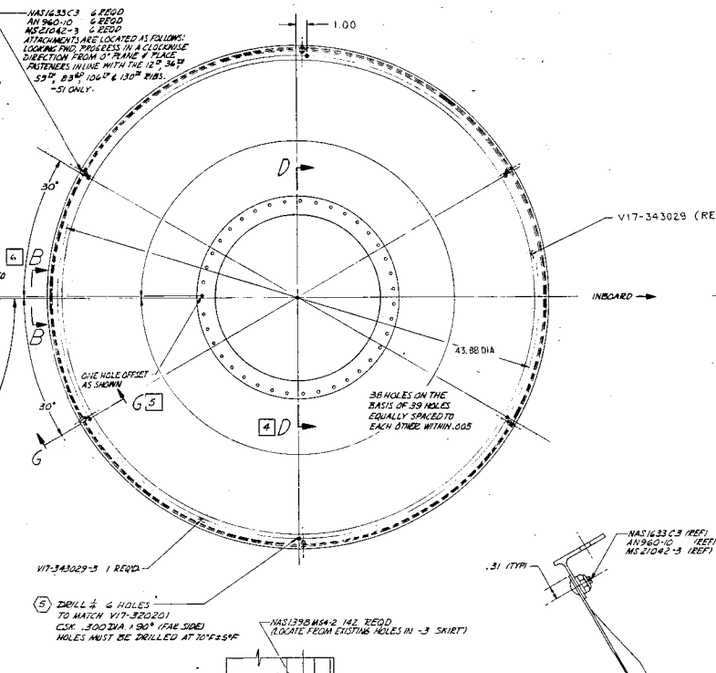
* STA 1 THEORETICAL THICKNESS ONLY DUE TO "RADIUS OVERLAP"

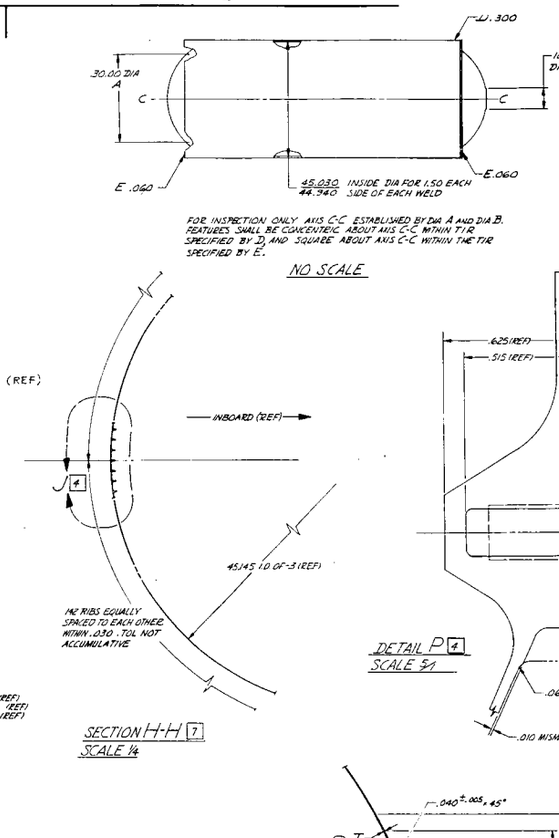
TABLE NO.2		
STA.	X_2 (R)	T_2
1	3.2000	.0450 +.005 -.000
2	3.4500	.0400 +.005 -.000
3	3.7000	.0362 +.005 -.000
4	3.9500	.0334 +.005 -.000
5	4.2000	.0310 +.005 -.000
6	4.4500	.0288 +.005 -.000
7	4.7000	.0270 +.005 -.000

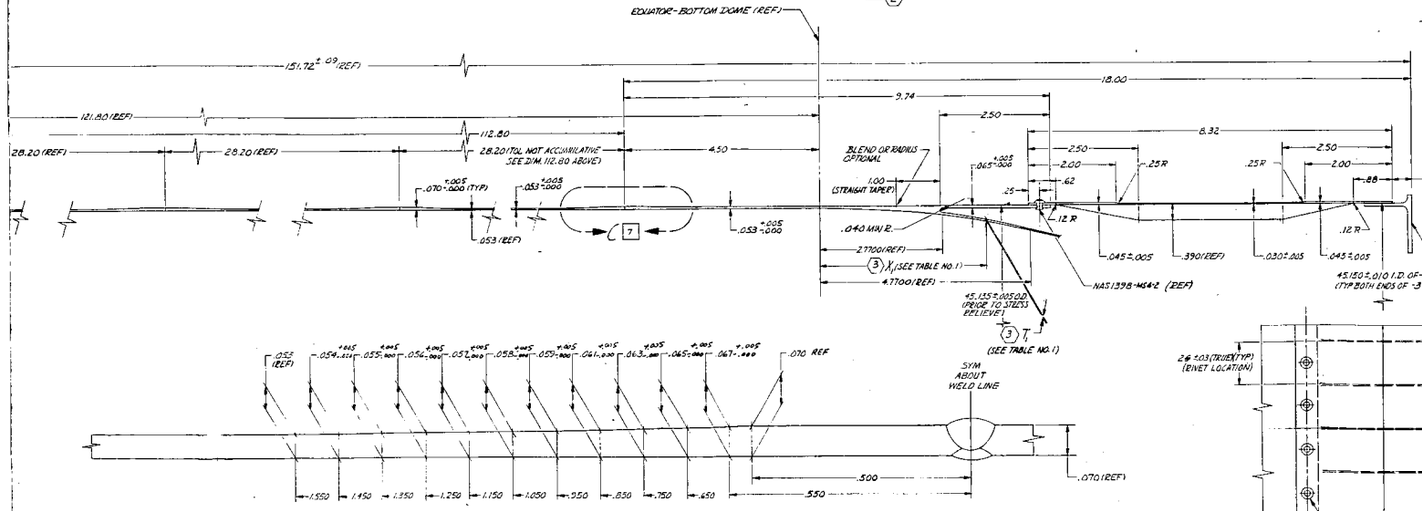
TABLE NO.3		
STA.	X_3 (R)	T_3
1	3.4000	.0500 +.005 -.000
2	3.4500	.0446 +.003 -.000
3	9.9000	.0400 +.005 -.000
4	10.1500	.0362 +.005 -.000
5	10.4000	.0326 +.005 -.000
6	10.6500	.0294 +.005 -.000
7	10.9000	.0270 +.005 -.000

V17-343002

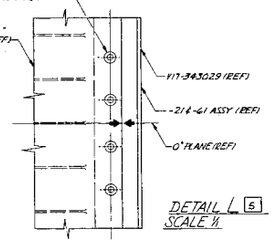




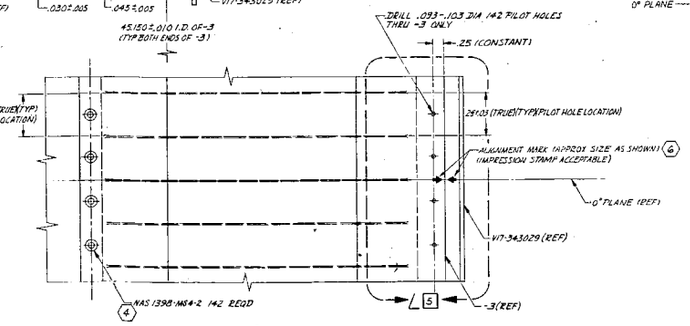




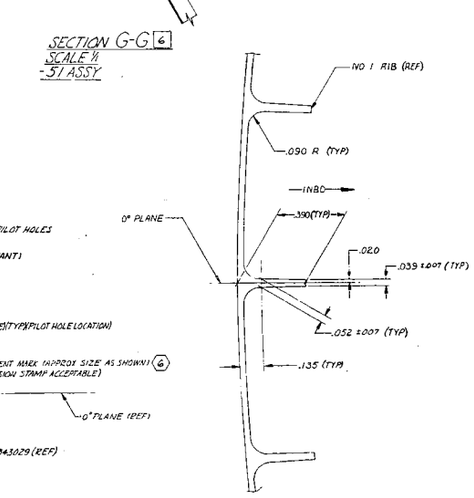
DETAIL C 7 3
SCALE 10/1
TYPICAL FOR ALL WELD LANDS AND TRANSITION AREAS IN CYLINDRICAL PORTION ONLY.



DETAIL L 5
SCALE 1/1



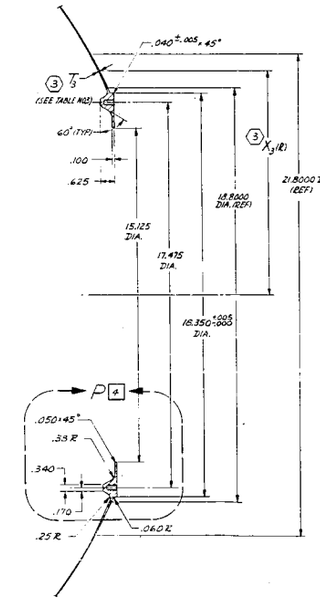
VIEW B-B 6
SCALE 1/1



DETAIL J 4
SCALE 4/1

SECTION H-H 7
SCALE 1/4

SECTION G-G 6
SCALE 1/1
-51 ASSY



SECTION D-D 5
SCALE 1/2

V17-343002 SHEET

C		EFFECT ON: ITEMS 2 & 3 END ITEM (2,4,6,& 7)		D.E. STACK 7-8-63
D		1. DELETED T21, T51, & T61 AND REINSTATED -21, -51, & -61 REQUIREMENTS.	3	
		2. DELETED NAS620 C10L & MS21043-3 AND REPLACED WITH AN960-10 & MS21042-3	4	
		3. ADDED 'S' CODE TO MONEL RIVET CALLOUT	3	
	4	4. REVISED DRILL NOTE & ADDED DETAIL 'F'	3	
		5. CODED RIVETS IN NTPL TO G/N	3	
		6. IN DETAIL 'E' ZONE 11; 2.00 +.12/-.03 DIA (WAS) 2.000 DIA, ADDED 2.000 DIA	3	
		7. REVISED G/N / ADDED TRACEABILITY BLOCK	3	
	5,6,10	8. SECT 'A-A' CHANGED DIMS: 45.150 ± .010 (WAS) 45.165 ± .005, 45.135 ± .005 O.D. (PRIOR TO STRESS RELIEVE) WAS 45.135 ± .005 O.D., 45.111 ± .005 O.D. (PRIOR TO STRESS RELIEVE) WAS 45.111 ± .005 O.D.	3	AA 10-22-63 D.E. STACK 10-1-63 CHK- D.E.C. 10-22-63
		EFFECT ON ITEM 2: NON SHOP PRACTICE		

REVISIONS

1. MAY BE REWORKED 2. CANNOT BE REWORKED 3. RECORD CHANGE 4. NON SHOP PRACTICE 5. PARTS MADE OK

SYM	ZONE	DESCRIPTION	CODE	DATE / APPROVED
A		WAS RECORD RELEASE ON E.O. [illegible]7781		
		1 REVISED GENERAL NOTES.	3	
		2 ADDED EFFECT ON	3	DE STACK 11 OCT 62
B		[illegible]	3	G. LINDERKUGEL 3-8-63
C	12	1. IN DETAIL 'F' ADDED BOSS & DIMS: 2.200 DIA, .12 R, 1.50 DIA, 1.00, 1.60, .06, .25 R & NOTE: THEORETICAL OUTSIDE SURFACE OF TANK	3	EDC M17007
	10,11	2. IN UPPER END VIEW, ADDED HOLES & NTPLS FOR UPPER SUPPORTS & THE LOCATING DIMS, & ADDED SECT 'M-M' & 'N-N'.	1	
	L/M,3, U/8	3. ADDED DET 'L' TO ESTABLISH NEW ASSEMBLY -61 OR T61 FOR AFRM 001 & REVISED -21 & T21 ASSY.	1	
	6-7	4. IN MAIN VIEW REMOVED WELD SYMBOLS & REPLACED THEM WITH (2).	3	
	12	5. IN DETAIL 'H' REMOVED NOTE: LOCATE RIVET WITHIN ±.03 OF 0° PLANE. ADDED NOTE: SKIRT OVERLAP JOINT IS AT 0° PLANE AS SHOWN ±.25.	3	
	10	6. IN TABLE NO 1 ADDED NOTE: STA 1 THEORETICAL THICKNESS ONLY DUE TO RADIUS OVERLAP	3	
	L/M, 4,9, D	7. DELETED -9 & -11. ADDED -17, -51, & -61,	3	EDC M17007
	5	8. END VIEW CHANGED NOTE: DRILL .213 ... TO MATCH V17 343017T WAS DRILL .213 ... TO MATCH V17 342017T.	3	
	6	9. MAIN VIEW 20.0000 DIA GAGE (WAS) 20.000 DIA (GAGE DIA).	3	
	7	10. SECT A-A; ADDED DIM .053 +.005/-.000	3	
	8	11. MAIN VIEW CHANGED OVERALL DIMENSION 165.15 ± .09 (WAS) 165.09 ± .09	3	EDC M17007
	L/M	12. I & T CODING ADDED	4	STRESS: D.B. [illegible]
		13. COMPLETELY REVISED GENERAL NOTES	3	

TRACEABILITY SYMBOLS

E	TRACEABILITY NOT REQUIRED	
T_S	TRACEABILITY BY SERIAL NUMBER	MA0201-0208
T_L	TRACEABILITY BY LOT NUMBER	MA0201-0209

(5) DRILL .213 TO DEPTH SHOWN WITH FLAT BOTTOM DRILL ±.03 CORNER R
TAP 1/4 - 28 UNF-3B. USE BOTTOMING TAP TO WITHIN 2 THREADS OF BOTTOM OF HOLE.
.410 MINIMUM FULL THREADS.
P.D. .2268 +.0032/-.0000 PER MIL-S-7742
HOLE PATTERN TO MATCH V17-343017, V17-480210, & V17-480211

MATERIAL PRIOR TO FINAL MACHINING

28. ALLOWABLE MISMATCH OF WELDED SECTIONS MEASURED ON I.D., AS FIXTURED, SHALL NOT EXCEED .010 AT ANY POINT OF THE CIRCUMFERENCE.
27. GRIT BLAST BAND SHALL BE 1.25 INCHES MAXIMUM ON EITHER SIDE OF ALL INSIDE WELDS PER ALLISON SPEC EPS 12015C, USING A CONTROLLED PROCESS APPROVED BY NAA ENGINEERING.
26. COMPLETE DATA REGARDING ANY INCLUSION WHICH IS DETECTED IN A FINISH MACHINED PART SHALL BE PRESENTED TO THE MATERIAL REVIEW BOARD FOR ACTION TO DETERMINE WHETHER THE INCLUSION IS DETRIMENTAL TO THE PERFORMANCE OF THE FINAL ARTICLE.
25. ALL ALUMINUM PARTS TO BE ANODIZED PER MIL-A-8625, TYPE I OR TYPE II.
24. TITANIUM TO ALUMINUM CONTACTING SURFACES, REQUIRE THE FOLLOWING: TITANIUM TO BE CLEANED PER MA0110-015, BOTH TITANIUM AND ALUMINUM TO RECEIVE ONE COAT OF ANDREW BROWN P-433-A-37875 WHITE EPOXY PRIMER PER MA0108-013.
23. RIVETS MAY BE INSTALLED IN ALUMINUM WITHOUT WHITE EPOXY PRIMER, BUT HOLES IN ALUMINUM SHALL BE ALODINE TREATED PER EPS 11785.
22. CONTACTING SURFACES OF BOTH A286 NUTPLATES AND ALUMINUM TO RECEIVE ONE COAT OF ANDREW BROWN P-433-A-37875 WHITE EPOXY PRIMER PER MA0108-013.
(4) 21. INSTALL RIVETS PER MA0101-006.
(5) 20. USE NAA MASTER T-7100018.
19. MAXIMUM WEIGHT NOT TO EXCEED 230.4 POUNDS. THIS LIMIT TAKES PRECEDENCE OVER WEIGHT RESULTING FROM MAXIMUM TOLERANCES USED CONSISTENTLY THROUGHOUT THE PART. COMPUTED WEIGHT USES 60 PERCENT OF MAXIMUM TOLERANCES.
18. SYMBOL ⊕ DENOTES EQUAL SPACES.
(6) 17 IDENTIFY, INCLUDING SERIALIZATION, PER LA0104-003 BY ELECTROCHEMICAL ETCHING PARA 4.3.6 EXCEPT SKIRTS TO BE INK STAMP MARKED.
16 MACHINE PER MA0103-005.
15. IN RIGGED POSITION 0° PLANE WILL PASS THROUGH CENTER OF TANK AND CENTER OF SERVICE MODULE.
14. EACH WELDMENT & LOWER SKIRT SHALL BE VISUALLY INSPECTED, FLUORESCENT PENETRANT INSPECTED PER MQ0501-004, TYPE I, CLASS II, & EACH WELDMENT RADIOGRAPHICALLY INSPECTED PER MQ0501-007 AFTER FINAL OPERATION.
13 QUALITY CONTROL SHALL BE IN CONFORMANCE WITH SPECIFICATION MQ0802-001. WELDING PROCESSES AND TEST BAND SAMPLING SHALL BE APPROVED BY ENGINEERING PRIOR TO PRODUCTION.
12 TEMPERATURE CONTROL OF FURNACE FOR HEAT TREATING SHALL BE IN ACCORDANCE WITH SPECIFICATION MIL-H-6875. STRESS RELIEVE AND AGE HARDENING TOLERANCE ON THE FURNACE SHALL BE ± 15°F.
11 WELD BEADS SHALL NOT BE PLANISHED. GRINDING, MACHINING, SCARFING, OR REPAIR SHALL BE DONE ONLY WITH THE PERMISSION OF ENGINEERING.
10. CYLINDRICAL SECTIONS SHALL BE TRACER MACHINED.
9 PRIOR TO WELDING, ALL SURFACE DEFECTS AND SUB-SURFACE CONDITIONS OF OXIDIZATION, SCALE, ETC. SHALL BE REMOVED DURING MACHINING.
8. ALL WELDED JOINTS SHALL BE FREE FROM EMBRITTLEMENT, AS DETERMINED DURING WELD DEVELOPMENT.
7. NO MATERIALS USED IN PROCESSING SHALL CONTAIN ANY OF THE HALOGENS.
(3) 6. CONTOUR SHALL BLEND SMOOTHLY. GRADIENT RATE OF CHANGE .005 IN/IN.
(1) 5. ALL WELDS SHALL BE STRESS RELIEVED PER LA0111-013, EXCEPT WELD ASSEMBLIES MAY BE STRESS RELIEVED AT 1000°F FOR 4 HOURS MIN & 8 HOURS MAX.. FINAL PROPERTIES AS DETERMINED BY 3 SPECIMENS, 120° APART, FROM EACH TITANIUM FORGING SHALL BE 160,000 PSI MIN ULT., 180,000 PSI MAX. ULT, 150,000 PSI MIN YIELD STRENGTHS, 8 PERCENT MIN ELONGATION & 20 PERCENT REDUCTION OF AREA IN ONE DIRECTION IN LIEU OF CORRESPONDING MATERIAL SPECIFICATION VALUES.
4. STATIONS & 'X' VALUES IN TABULATIONS DO NOT REFER TO SPACECRAFT LOCATIONS
(2) 3. DELIVER PER ALLISON SPEC EPS 14635 B. WELD DEFECTS PER ALLISON SPEC EIS 1206.
2. WELD WIRE TO BE PER LB0170-126, CLASS I, EXCEPT OXYGEN CONTENT TO BE .09 PERCENT MIN AND .2 PERCENT MAX. INCLUDING CHECK ANALYSIS TOL.
1. MACHINED SURFACES TO BE 63 ✓.

NOTES: UNLESS OTHERWISE SPECIFIED

LIST OF MATERIAL OR PARTS LIST

QTY RFC	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT	MATERIAL	T_S/T	DATA SPECIFICATION SIZES, NOTES, SUPPLIERS	ZONE	LINE NO.
																045
																044
																043
																042
																041
																040
																039
																038
																037
																036
																035
		1	1	1					V17-343030 T3	RING			T_S			0
		1	1	1					V17-343029 T3	RING			T_S			0
		1	1						T17	UPPER DOME		MAKE FROM V17-343033 T	T_S			0
		4	4	4					T15	CYLINDER		MAKE FROM V17-343031 T	T_S			0
				1					T13	UPPER DOME		MAKE FROM V17-343033 T5	T_S			0
		1	1	1					T7	LOWER DOME		MAKE FROM V17-343033 T3	T_S			0
		1	1	1					T5	SKIRT		BARE 2024-T4 AL ALLOY SHEET	T_L	.032 × 11.5 × .42 QQ-A-355		02
		1	1	1					V17-343002 T3	SKIRT		MAKE FROM V17-343034 T	T_S			02
		36	36	36	36	36	36		NAS697 C3	NUTPLATE		-	E		5	020
		10	10	10	10	10	10		NAS1398 D4-1	RIVET			E		11	019
		72	72	72	72	72	72		NAS1398 D4-2	RIVET			E		10	018
		356	214	214	356	214	214		NAS1398 MS4-2	RIVET			E		6/10	017
						6			NAS1283 C3	BOLT			E		4	016
						6			AN960-10	WASHER			E		4	015
						6			MS21042-3	NUT			E		4	014
					1	1	1		V17-343030-3	RING			T_S		10	
					1	1	1		V17-343029-3	RING			T_S		6	
									~~-71~~	~~WELD ASSY~~						
									~~-41~~	~~WELD ASSY~~					8	
									~~-31~~	~~WELD ASSY~~					9	
					1	1			-17	UPPER DOME		MAKE FROM V17-343033-5	T_S		10	
					4	4	4		-15	CYLINDER		MAKE FROM V17-343031	T_S		9	
							1		-13	UPPER DOME		MAKE FROM V17-343033-5	T_S		10	
									~~-9~~	~~DOME~~		MAKE FROM V17-343033			10	
					1	1	1		-7	LOWER DOME		MAKE FROM V17-343033-3	T_S		6	
					1	1	1		-5	SKIRT UPPER		BARE 2024-T4 AL ALLOY SHEET	T_L		10	
					1	1	1		-3	SKIRT LOWER		MAKE FROM V17-343034	T_S		6	
		T61	T51	T21	-61	-51	-21	-11	V17-343002	ASSY			T_S			

APPLICATION (USAGE) DATA

ITEM	QTY REQD PER END ITEM	MODEL	NEXT USING DRAWING	END ITEM NO.	THRU (EFFECTIVE ON)
-51	2	V17-3	V17-343001	29, 30, 31, 32, 34	37
-51	2	V17-3	V17-343001	16, 17, 18, 20, 21, 24, 25, 27	—
-5	2	V17-3	V17-343001	2, 4, 6, 7, 12	14
-61	2	V17-3	V17-343001	1	ONLY

HEAT TREAT (1)

FINISH NONE

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ON: DECIMALS .XX = ± .03, .XXX = ± .010; ANGLES ± 30'

HOLES NOTED "DRILL":
.013 THRU .040 : +.001 -.001
.041 THRU .130 : +.002 -.001
.131 THRU .229 : +.003 -.001
.230 THRU .500 : +.004 -.001
.501 THRU .750 : +.005 -.001
.751 THRU 1.000 : +.007 -.001
1.001 THRU 2.000 : +.010 -.001

DO NOT SCALE PRINT

DR BY F. BURKE | CHK BY [illegible] | APPROVED BY [illegible]

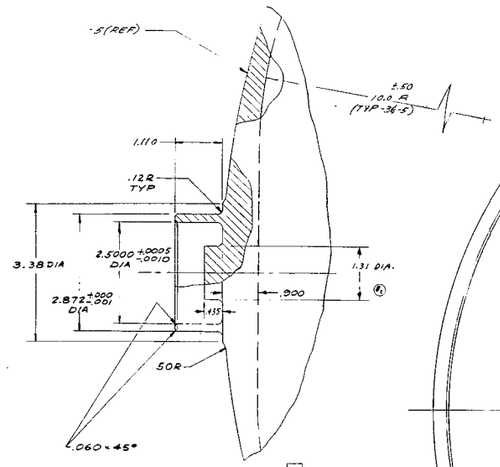
NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

TANK ASSEMBLY - MAIN PROPELLANT, FUEL

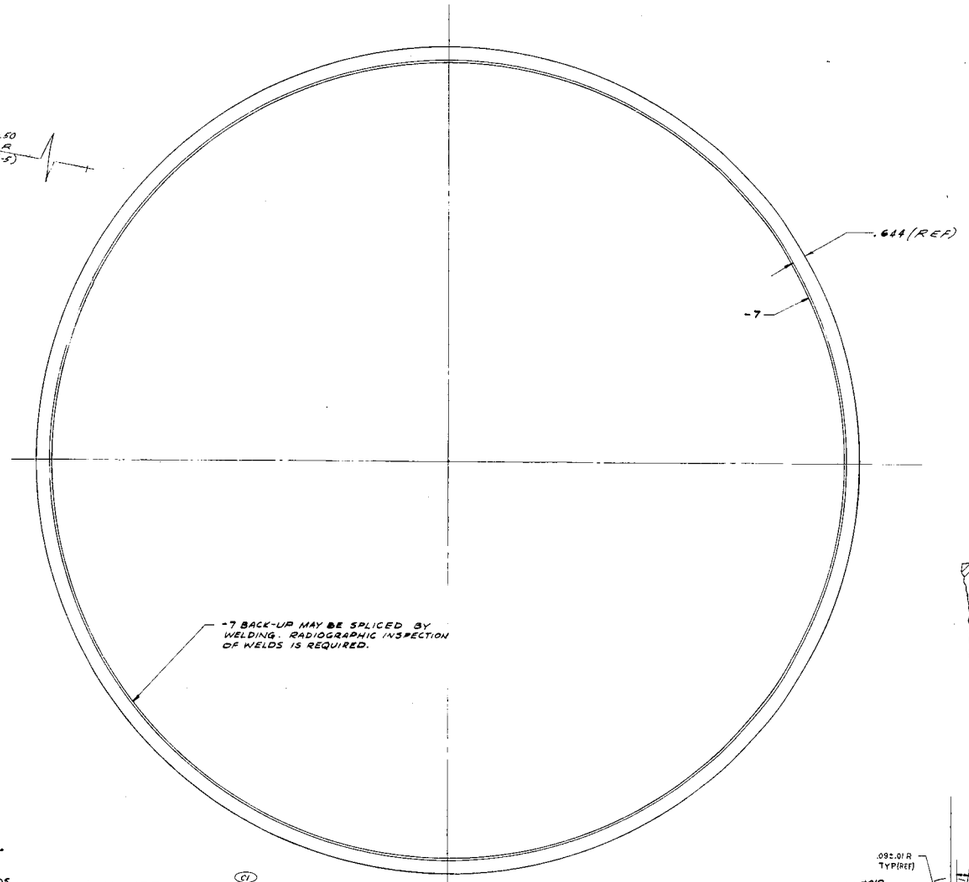
CODE IDENT NO 03953 | SIZE J | V17-343002

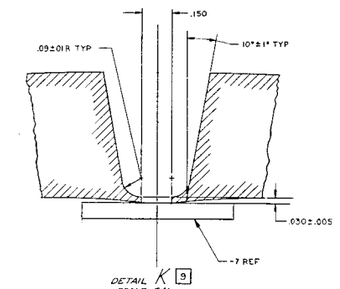
SCALE | SHEET

Figure 4-5. Tank Assembly: Main Propellant, Fuel (V17-343002)

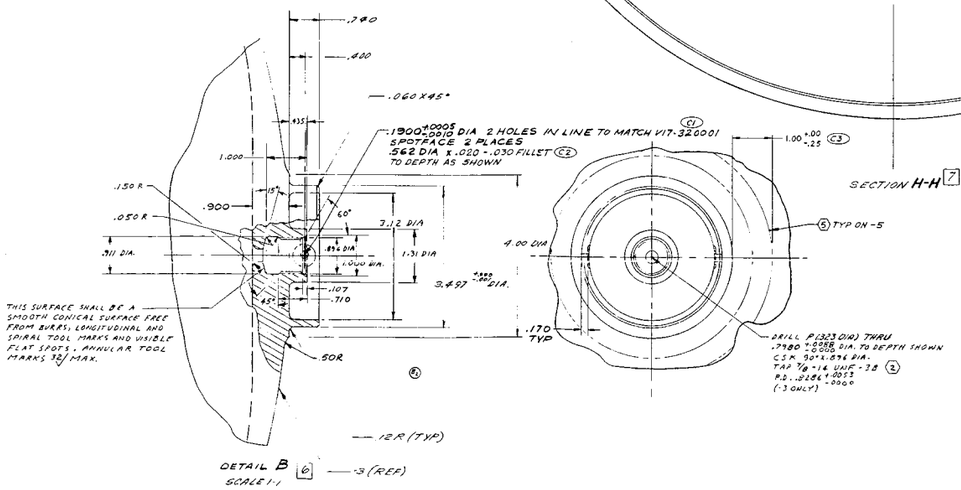


DETAIL C [2]
SCALE 1-1



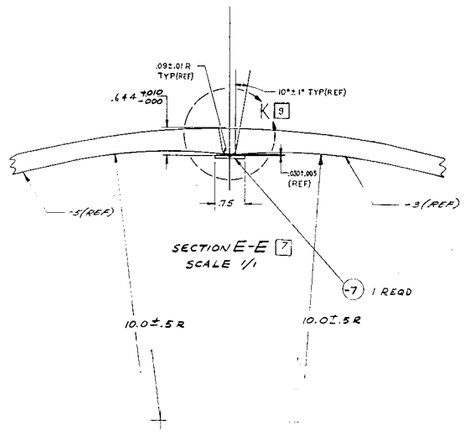


DETAIL K [9]
SCALE 5/1



DETAIL B [6]
SCALE 1-1

SECTION H-H [7]

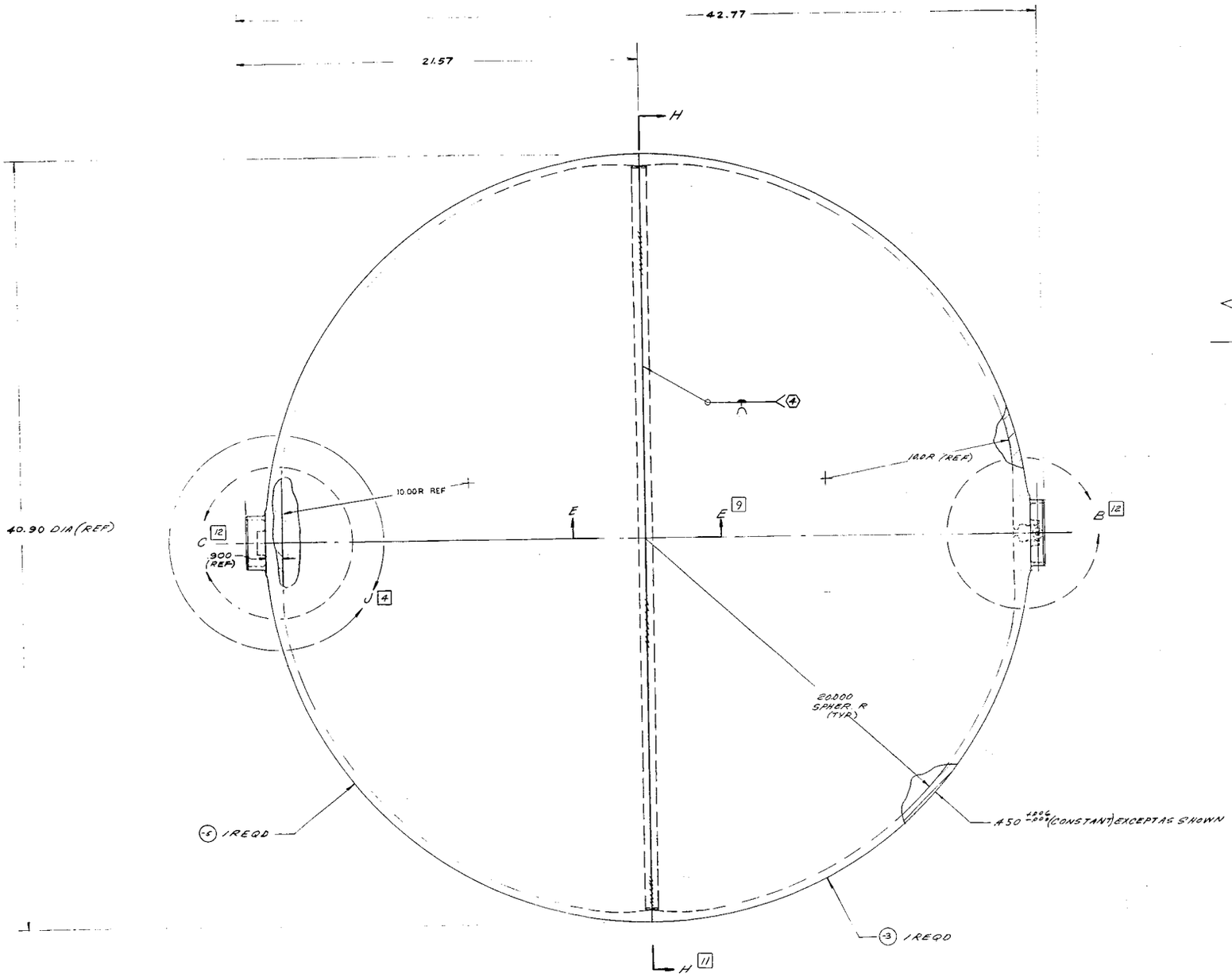


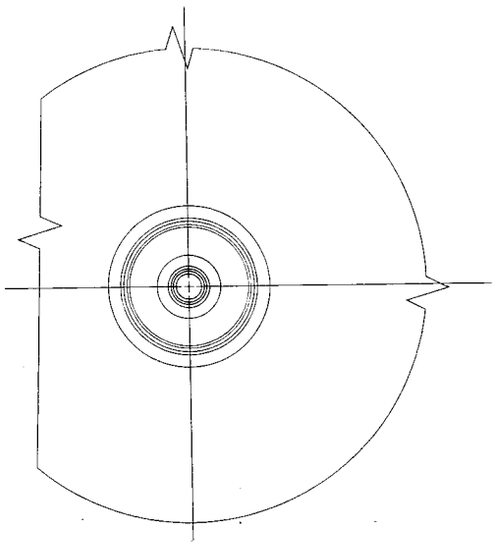
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SCALE 1/1

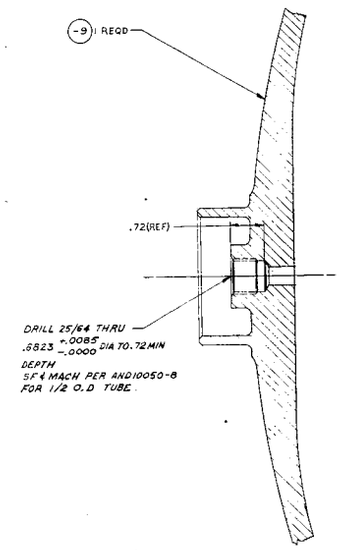
V17-347002

2

8 7 6 5 4







DETAIL J 8 (-5)
(SCALE 1/1)
(-9 IDENTICAL TO -5 EXCEPT AS SHOWN)

V17-347002 SHEET

8 7 6 5 4

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION

Volume: DIM-9
Section: 4
Page: 7
Date: 2-19-64
Rev. Date:

REVISIONS

SYM	ZONE	DESCRIPTION	DATE	APPROVED
		1. MAY BE REWORKED 2. CANNOT BE REWORKED 3. RECORD CHANGE 4. NOW SHOP PRACTICE 5. PARTS MADE OR		
A		WAS RECORD RELEASE ON E.O. 677 P2. 1. REVISED GENERAL NOTES 2 2. ADDED EFFECT ON	5 5	DESTARK 10/17/62
B		1. REVISED TO CONFORM WITH SUBCONTRACTOR PROPOSAL	3	
	11,12	2. BOSS ADDED & ORIFICE REVISED.	3	
C	11,12	1. TO MATCH V17-320001 WAS V17-324013.	3	
	11,12	2. .562 DIA x .020-.030 FILLET TO DEPTH AS SHOWN WAS .562 DIA TO DEPTH AS SHOWN.	3	
	11	3. ADDED IDENTIFICATION AREA.	3	
	F/D	4. ADDED TRACEABILITY SYMBOL BLOCK.	3	F.B.RICE SEP 12, 63
		5. ADDED -11 & DETAIL J	3	
	G/N	6. ADDED "REISSUE 24 JUNE 63" TO S/N NO. 14.	3	
	L/M	7. -34-5 MAKE FROM V17-347003 WAS -34-5 MAKE FROM V17-347000	3	D.B.[illegible] 2-19-64

27. THE FOLLOWING AIRITE PRODUCT SPECIFICATIONS OF THE ISSUE IN EFFECT AS OF 15 FEB 1963 MAY BE USED IN LIEU OF RELATED NAA SPECIFICATIONS PROVIDED ALL END ITEM REQUIREMENTS OF THE NAA DRAWINGS, SPECIFICATIONS & STATEMENT OF WORK ARE MET OR EXCEEDED: 59-00016, 71-00050, 71-00051, 71-00052 & 60-00015.
26. PENETRANT INSPECT ALL SURFACES PER MQ 0501-004 AFTER MACHINING & BEFORE WELDING.
25. MACHINE PER MA 0103-005.
24. -7 BACKUP TO BE FLOURESCENT PENETRANT INSPECTED PER MQ0501-004.
23. WELD REPAIRS MUST BE AUTHORIZED BY ENGINEERING & MUST BE COMPLETELY RE-INSPECTED.
22. EACH WELDMENT SHALL BE VISUALLY INSPECTED, FLUORESCENT PENETRANT INSPECTED PER MQ0501-004 & RADIOGRAPHICALLY INSPECTED PER MQ 0501-007 AFTER FINAL OPERATIONS.
21. QUALITY CONTROL SHALL BE IN CONFORMANCE WITH SPECIFICATION MQ 0802-001. WELDING PROCESSES & TEST SAND SAMPLING SHALL BE APPROVED BY ENGINEERING PRIOR TO PRODUCTION.
20. TEMPERATURE CONTROL OF FURNACE FOR HEAT TREATING SHALL BE IN ACCORDANCE WITH SPECIFICATION MIL-H-6875. STRESS RELIEVE AND AGE HARDENING TOLERANCE ON THE FURNACE SHALL BE ±15°F.
(1) 19. HEAT TREAT -3-34-3 PER LA011-008 AFTER ROUGH MACHINING.
18. WELD BEADS SHALL NOT BE PLANISHED. GRINDING, MACHINING, SCARFING, OR REPAIR SHALL BE DONE ONLY WITH THE PERMISSION OF ENGINEERING.
17. PRIOR TO WELDING, ALL SURFACE DEFECTS & SUB-SURFACE CONDITIONS OF OXIDATION, SCALE, ETC SHALL BE REMOVED DURING MACHINING.
16. ALL WELDED JOINTS SHALL BE FREE FROM EMBRITTLEMENT.
15. COMPLETE PENETRATION SHALL BE ACHIEVED THRU-OUT THE LENGTH OF THE WELD.
14. QUALIFICATION & ACCEPTANCE REQUIREMENTS SHALL BE PER SID 62-1259, REISSUE 24 JUNE 63.
13. THE WIDTH OF THE WELD BEAD SHALL BE NO GREATER THAN 3 TIMES THE THICKNESS OF THE WELD JOINT AT ANY POINT. THE MAXIMUM BUILD UP OF THE WELD BEAD SHALL BE WITHIN 15% OF THE MATERIAL THICKNESS, AND THE MAXIMUM DROP-THROUGH OF THE WELD BEAD SHALL BE WITHIN 10% OF THE MATERIAL THICKNESS.
12. ALLOWABLE MISMATCH OF WELDED SECTIONS SHALL BE WITHIN 5% OF THE MATERIAL THICKNESS. A MISMATCH OF MORE THAN 5% OF THE MATERIAL THICKNESS SHALL NOT EXTEND MORE THAN 20% OF THE LENGTH OF THE WELD.
11. THREE HEAT TREAT SPECIMENS SHALL BE TESTED FROM MATERIAL REMOVED FROM EACH FORGING AFTER FINAL AGE/STRESS RELIEVE. THE FOLLOWING PHYSICAL PROPERTIES SHALL BE OBTAINED: 160,000 PSI MINIMUM ULTIMATE & 150,000 PSI MINIMUM YIELD STRENGTHS, 8% MINIMUM ELONGATION, 20% MINIMUM REDUCTION OF AREA.
10. ALL WELDS SHALL BE STRESS RELIEVED PER LA011-013. POST-WELD AGING IN LIEU OF STRESS RELIEVE IS ACCEPTABLE PROVIDED PHYSICAL PROPERTIES PER LB0170-138 & NOTE 11 ARE ACHIEVED & APPROVAL IS GIVEN BY ENGINEERING.
(4) 9. WELDING PER MA0107-001 SHALL BE ACCOMPLISHED IN A CHAMBER BY AUTOMATIC TUNGSTEN INERT GAS PROCESS. PRIOR TO WELDING, THE CHAMBER SHALL BE EVACUATED TO A PRESSURE EQUAL TO 5 MICRONS OF MERCURY. THE CHAMBER SHALL BE FLUSHED TWICE WITH ARGON HAVING A DEW POINT OF MINUS 80°F TO A PRESSURE OF 15 PSIA. THE CHAMBER SHALL THEN BE REFILLED WITH PURE ARGON TO A PRESSURE OF 3 PSIG AND MAINTAINED DURING WELDING. FILLER WIRE TO BE 6AL-4V TITANIUM PER AMS 4928.
8. NO MATERIALS USED IN PROCESSING SHALL CONTAIN IMPURITIES OF SULPHUR OR THE HALOGENS. NO MAGNESIUM, CADMIUM, OR ZINC SHALL BE USED.
7. MACHINED SURFACES TO BE 63.
6. MAX. WEIGHT NOT TO EXCEED 387 LB.
(2) 5. THREADS PER MIL-S-7742.
(3) 4. INTERIOR & EXTERIOR SURFACES ARE NOT TO BE PAINTED OR CHEMICALLY TREATED FOR PRESERVATION & SHALL BE FREE FROM ALL BLEMISHES, NICKS, SCRATCHES OR OTHER IMPERFECTIONS.
(5) 3. IDENTIFY PER LA 0104-003, INCLUDING SERIALIZATION, & REV. LETTER DO NOT IMPRESSION STAMP & WITHIN ONE INCH OF BOSS.
2. PACKAGING OF THE TANK SHALL BE PER MA0116-014.
1. CLEANING SHALL BE ACCOMPLISHED AFTER ALL ACCEPTANCE TESTS EXCEPT CLEANLINESS TESTS HAVE BEEN COMPLETED. REQUIREMENTS OF SPEC. MA 0610-004 SHALL BE MET.
NOTES: UNLESS OTHERWISE SPECIFIED

TRACEABILITY SYMBOLS		
E	TRACEABILITY NOT REQUIRED	
S	TRACEABILITY BY SERIAL NUMBER	MA0201-0208
L	TRACEABILITY BY LOT NUMBER	MA0201-0209

QTY REQD	QTY REQD	QTY REQD	MET	QTY REQD	QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT	MATERIAL	DATA: SPECIFICATION SIZES, NOTES, SUPPLIERS	ZONE	LINE NO.
												045
												044
												043
												042
												041
												040
												039
												038
												037
												036
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												010
												009
												008
												007
												006
(C5)			T8	1		-9	DOME				4	005
			T8	1	1	-7	BACK-UP				9	004
			T8	1	1	-5	DOME				8	003
			T8	1	1	-3	DOME				6	002
			T8	-11	BASIC	V17-347002	HELIUM TANK					001

LIST OF MATERIAL OR PARTS LIST

ITEM	QTY REQD PER END ITEM	MODEL	NEXT USING DRAWING	END ITEM NO.	THRU EFFECTIVE ON
BASIC	2	V17-3	V17-340001	6	7
BASIC	2	V17-3	V17-340001	4	ONLY
BASIC	2	V17-3	V17-340001	2	ONLY
BASIC	2	V17-3	V17-340001	1	ONLY

APPLICATION (USAGE) DATA

HEAT TREAT (1)
FINISH (3)

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON: DECIMALS .XX ± .03, .XXX ± .010; ANGLES ± 30'. HOLES NOTED "DRILL": .013 THRU .040 ±.001-.001; .041 THRU .130 ±.002-.001; .131 THRU .229 ±.003-.001; .230 THRU .500 ±.004-.001; .501 THRU .750 ±.005-.001; .751 THRU 1.000 ±.007-.001; 1.001 THRU 2.000 ±.010-.001. DO NOT SCALE PRINT

DR BY: DIMI-GAMONIT 6/18/62
CHK BY: [illegible] 12-6-64
APPROVED BY: [illegible]

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

HELIUM TANK - MAIN PROPELLANT, ASSEMBLY OF

CODE IDENT NO. 03953 | SIZE J | V17-347002

SCALE: 1/4 NONE | SHEET

AIRITE 00407 V17-347002 C

Figure 4-6. Tank Assembly: Main Propellant, Helium (V17-347002)

4.2.5 The weight and volume capacity of each pressurant tank are 390 pounds and 19 cubic feet, respectively. The outside diameter of each is about 41 inches.

4.2.6 Drawing V17-342025, "Assembly of Upper Skirt Support, Oxidizer Tank" (Figure 4-7), presents typical support details of these large oxidizer and fuel tanks at the forward bulkhead. Support details for these same tanks at the aft bulkhead are found in Figures 2-10 through 2-13.

4.3 Operating Conditions

4.3.1 In a normal launch mission, the SPS tanks will store (without loss of contents) and supply under pressure the necessary fuel and oxidizing agent to the SPS engine for all maneuvers between transpositional docking and earth trajectory. A temperature range of 40-80 F will be maintained.

4.3.2 In a launch abort mission, the SPS tanks will provide sufficient fuel and oxidizer under necessary pressure to enable SPS engine operation for bringing the C/M successfully into earth reentry.

4.4 Design Characteristics and Criteria

4.4.1 Criteria useful in design of SPS components of tank structures may be found in ARM-6.

4.4.2 The environmental requirements listed for the S/M in 2.4.1 are equally valid for the SPS tank structures.

4.5 Test Requirements

4.5.1 Test requirements for the SPS tank structures are stated in SID 62-109-2, "General Test Plan, Research and Development for Project Apollo Spacecraft - Individual System Test."

4.5.2 Tests already completed and covered by released ATR's are these:

ATR NO.	NAME OF TEST
301-4	Static Test of Tank Skirt
301-8	SPS Main Propellant Tank Cover Door
301-13	Seal Test - S/M, Main Propellant Manhole Door
302-1	Pressure Vessel Tests - S/M Pressurant and Propellant Tanks
305	S/M Fuel and Oxidizer Tank Fastener Tests

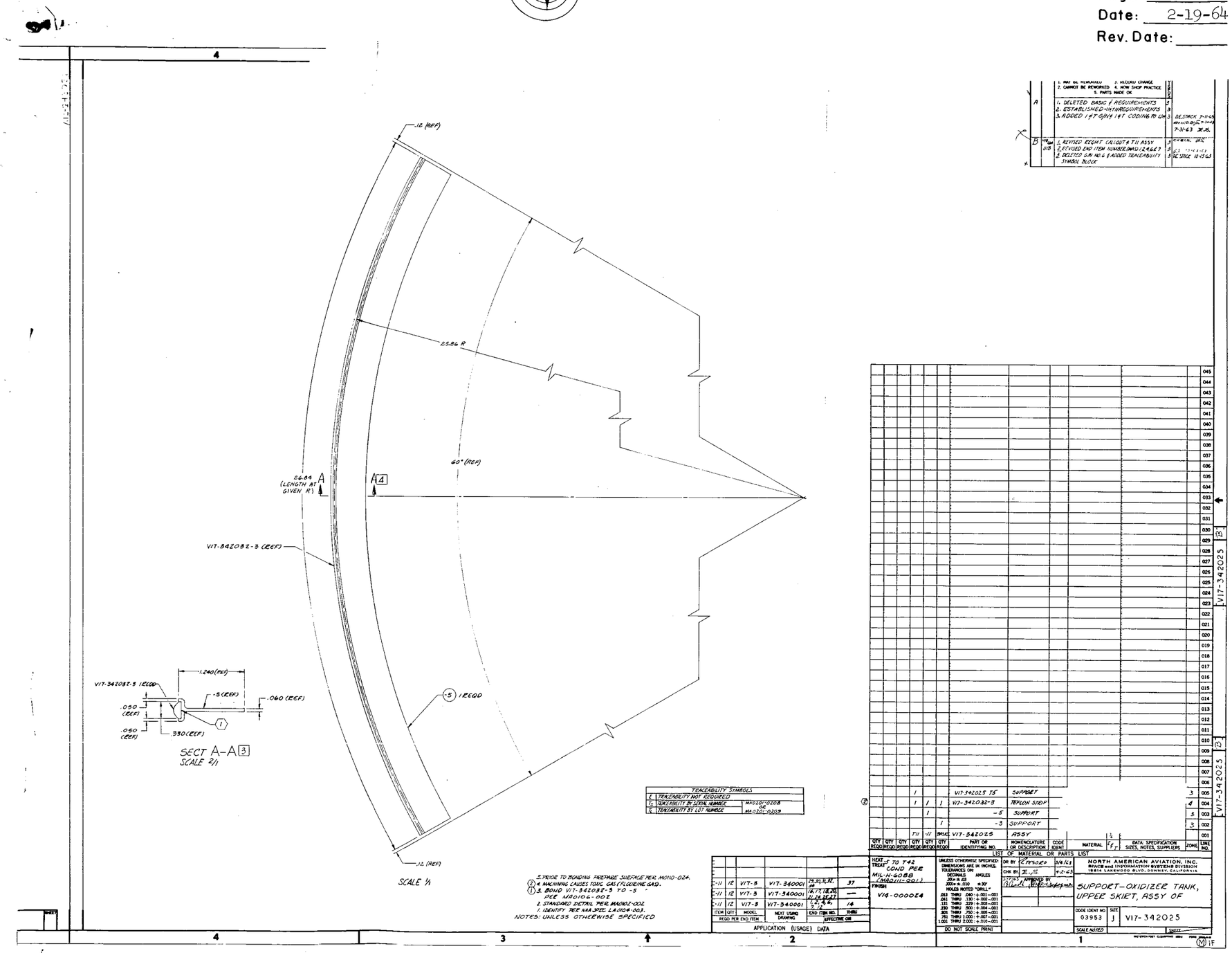


Figure 4-7. Assembly of Upper Skirt Support, Oxidizer Tank (V17-342025)

4.5.3 Particular fabrication test requirements for the subcontractors of the SPS tanks are called out in SID 62-1259 (reissued 12 February 1963), "Statement of Work for Testing of Pressurant and Propellant Tanks, Project Apollo."

5.0 SYSTEMS MOUNTING PROVISIONS

5.1 General

5.1.1 Mounting provisions (or support structures) are a requirement for the following systems:

a. Environmental control system
b. Reaction control system
c. Service propulsion system
d. Electrical power system
e. Telecommunication system

5.1.2 The subject matter of this section of DIM-9 is confined to configuration details supported by drawings.

5.1.3 The function of systems-support structures is self-explanatory. Any variables in the treatment of the environmental requirements other than those found in 2.4.1 will be stated. Again, operating conditions for these mounting provisions differ in no way from the conditions imposed on the structures supported by them. Likewise, design characteristics and criteria for component configuration are also given in ARM-6. Finally, only one test requirement exists for the testing of systems-mounting provisions. It is ATR 301-11, "Fittings and Equipment Support," and it is yet unwritten, pending completion of test.

5.2 ECS Mounting Provisions Configuration

5.2.1 Drawing V17-331717, "Mounting Provisions, Environmental Control Systems Installations" (Figures 5-1 through 5-3) shows configuration details for supporting structures of this system.

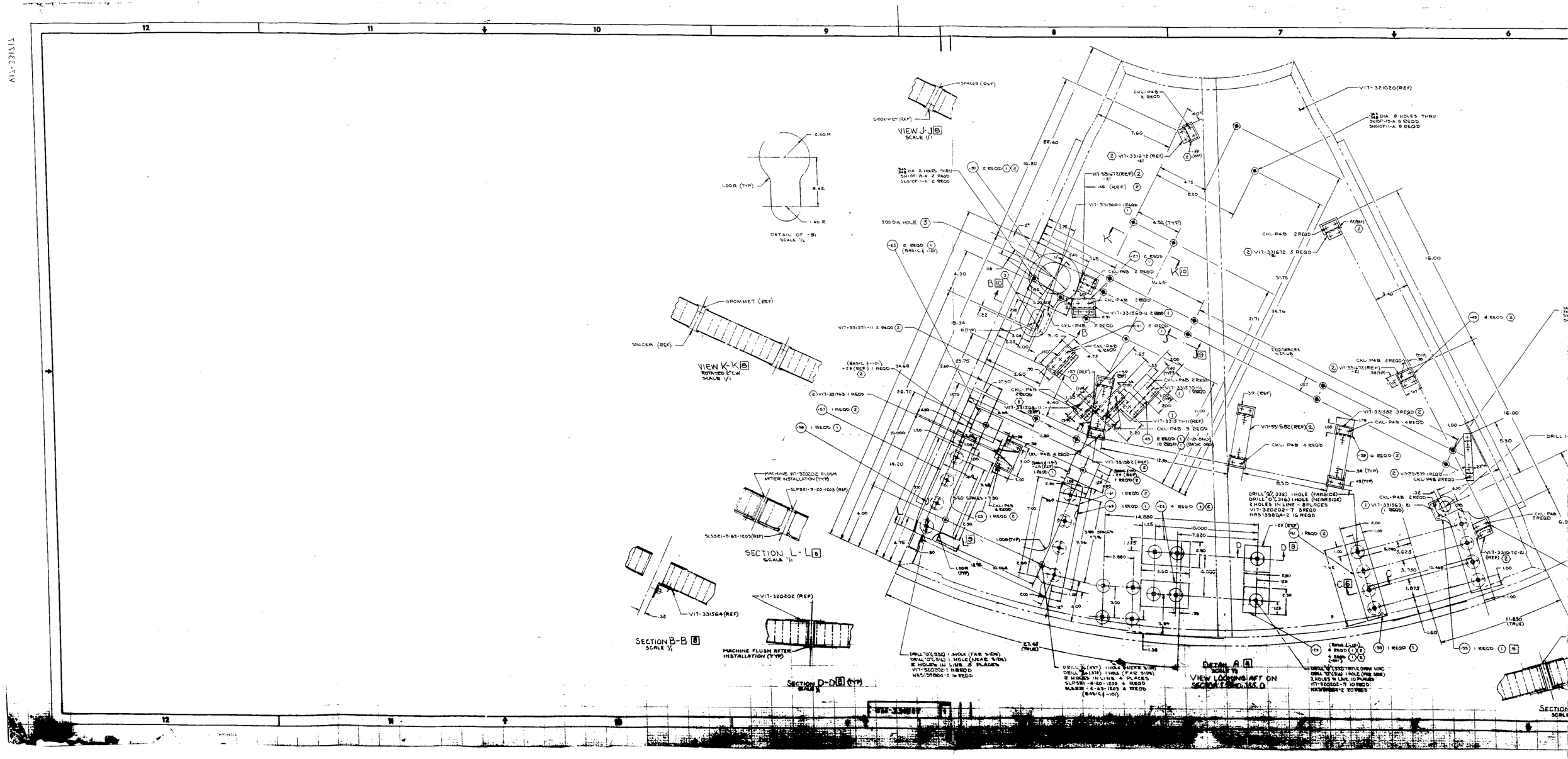
5.2.2 Particular details concerning the LO_2 supercritical storage bottles are found in drawing V17-331667, "Assembly of Oxygen Tank Shelf Support" (Figure 5-4).

5.2.3 Space radiators in Sectors Two and Five are ECS components for which special support structures need design. The drawings for these are in preparation.

5.2.4 Valving and hard line supports in the ECS are mounted by means of brackets, often of special design.

5.3 RCS Mounting Provisions Configuration

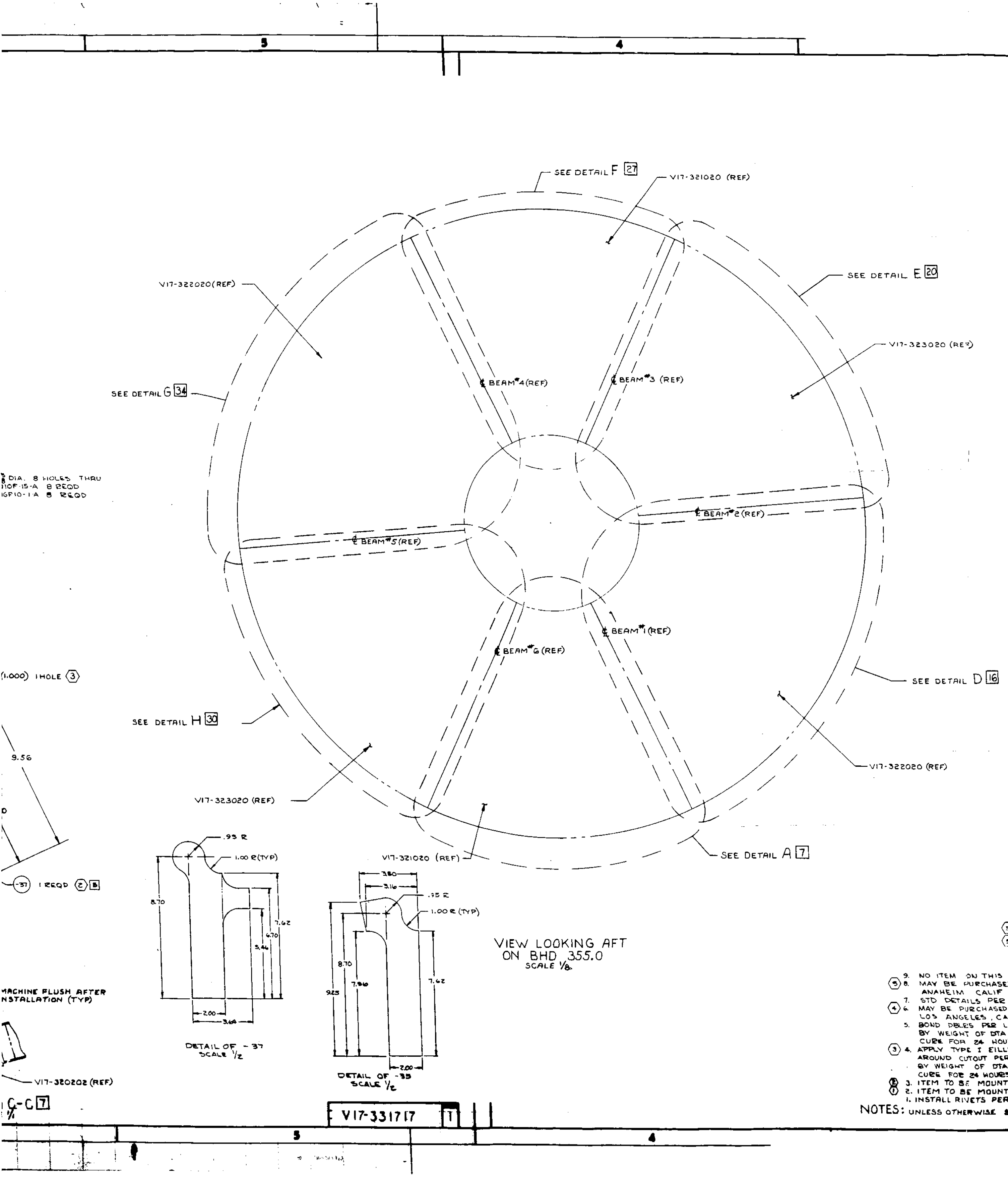
5.3.1 Drawing V17-332000, "Module Installation of Reaction Control System" (Figure 5-5), and drawing V17-332001, "Panel Assembly


VIEW J-J
SCALE 1/1
SPACER (REF)
GROMMET (REF)
DETAIL OF -31
SCALE 1/1
2.40 R
1.00 R (TYP)
9.42
1.40 R
VIEW K-K
ROTATED 2° CW
SCALE 1/1
GROMMET (REF)
SPACER (REF)
SECTION L-L
SCALE 1/1
MACHINE V17-320202 FLUSH AFTER INSTALLATION (TYP)
SLP521-3-20-1203 (REF)
SL5521-3-63-1203(REF)
SECTION B-B
SCALE 1/1
V17-320202 (REF)
V17-331564(REF)
MACHINE FLUSH AFTER INSTALLATION (TYP)
SECTION D-D (TYP)
SCALE 1/1
V17-321020(REF)
V17-331672(REF)
V17-331564-11 1 REQD
V17-331871-11 2 REQD
V17-331763 1 REQD
V17-331582 3 REQD
V17-331570 1 REQD
V17-331571-11(REF)
V17-331582(REF)
V17-331539 1 REQD
V17-331563-21
V17-331672-21
V17-320202-7 8 REQD
NAS1398D4-2 16 REQD
DETAIL A
SCALE 1/2
VIEW LOOKING AFT ON
SECTION LINE D

2

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION

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Section: 5
Page: 2
Date: 2-19-64
Rev. Date: ______



		1. SEE SHT 3		MCR 354
		2. SEE SHT 2		MCR 354
	L/M F/D	3. V17-331564-11 (WAS) V17-331564 V17-331563-21 (WAS) V17-331563	1 1	
		4. SEE SHT 3		
		5. SEE SHT 2		
	9	6. DETAIL OF -51 (WAS) DETAIL OF -47 SH 2 (WAS) 4.50	3	EO M159527
	8	7. -51 2 REQD (WAS) -49 2 REQD	3	EO M159527
B	L/M	8. SEE SHT 3		
		9. ADDED "E" TO ITEMS 002 THRU 015	3	EO M160191
	8	10. ADDED SN10F & SNG10F & LOCATING DIMS, CORRECTED L/M	1	
	L/M	11. CREATED -101 ADDED REQ FOR V17-2 #12	3 3	EO M160192 EO M160163 MCR 242
		12. SEE SHT 3		
	L/M F/D	13. V17-331569-11 (WAS) V17-331569 V17-331570-11 (WAS) V17-331570 V17-331672-21 (WAS) V17-331672-11	1 1 1	
		14. ADDED REQ FOR V17-3 END ITEM 10 & CREATED -201	3	
	8 L/M	15. ADDED 4 SL521 IUS & LOCATING DIMS & -55, -57, -59, -61, -63 & -65 REMOVED -15, -17, -19 & -21 EFFECT ON ITEMS 1,2,3,5,10,12,13 & 15 V17-3 END ITEMS 2,4,6,7,10,12 & 14 V17-2 END ITEM 12 ITEM 10 & 15 V17-3 END ITEMS 1,2,4,6,7,10,12 & 14 V17-2 END ITEM 12	1	RDC 24331 Stallhamger 10 DEC 63

REVISIONS

SYM	ZONE	DESCRIPTION		DATE	APPROVED
		1. MAY BE REWORKED 3. RECORD CHANGE 2. CANNOT BE REWORKED 4. NOW SHOP PRACTICE 5. PARTS MADE OK			
A	L/M	1. ADDED -3 THRU -47	/		
	9	2. ADDED 34.68 DIM	/		
	8	3. ADDED 3.04 DIM	/		
	8	4. 12° (WAS) 6°	/		
	L/M	5. ADDED CKL-P4B & CKL-P4F	/		
	L/M	6. REMOVED NAS1398D4-3	/		
	17	7. REMOVED 14.92, 5.00, .80 & 5.00	3	EO M148069	
	27	8. ADDED 4.50, 20.40, 3.40 & 1.06	3	EO M148069	
	3	9. ADDED GENL NOTE 5 THRU 8	3		
	8	10. 22.40 (WAS) 23.06			
	L/M	11. REMOVED V17-321011, V17-321010-7 & K7031-3-4	/		
	7	12. 4.75(WAS)6.12, 8.20(WAS) 9.52, 31.75(WAS) 30.62 & 34.76(WAS) 33.28 (ADDED) 11.01	/		
	L/M	13. (ADDED) SN10F-5-A & SNG10F-1A EFFECT ON: ITEMS 1 THRU 6 & 11 THRU 13 END ITEMS 1,2,4,6,7 & 8	/	7 Oct 63	Stallhamger CHK KLUG 10-28-63

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	PART OR IDENTIFICATION NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT	MATERIAL	DATA: SPECIFICATION SIZES, NOTES, SUPPLIERS	ZONE	LINE NO.
												079
												078
												077
												076
												075
												074
												073
												072
												071
												070
												069
												068
												067
												066
												065
												064
												063
												062
												061
												060
												059
												058
												057
												056
(5)				4	4	SL5581-4-63-1203	SPACER				8	055
(5)				4	4	SLP531-4-20-1203	PLUG				8	054

QTY REQD	QTY REQD	QTY REQD	QTY REQD -201	QTY REQD -101	QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT	MATERIAL	DATA: SPECIFICATION SIZES, NOTES, SUPPLIERS	ZONE	LINE NO.
				2	2	-65	DBLR		ALUM ALLOY SHT	QQ-A-283 7075-T6 .063 x 2.50 x 2.50	9	053
			1	1	1	-63	DBLR		ALUM ALLOY SHT	QQ-A-283 7075-T6 .063 x 3.60 x 9.96	9	052
			1	1	1	-61				QQ-A-283 7075-T6 .020 x 3.60 x 9.96	9	051
			1	1	1	-59				QQ-A-283 7075-T6 .063 x 3.60 x 9.30	8	050
			1	1	1	-57				QQ-A-283 7075-T6 .020 x 3.60 x 9.30	8	049
					4	-55				QQ-A-283 7075-T6 .016 x 2.00 x 3.64	26	048
			4		4	-53				QQ-A-283 7075-T6 .016 x .76 x .78	18	047
			2	2	2	-51				QQ-A-283 7075-T6 .016 x 4.80 x 9.22	9	046
			4		4	-49				QQ-A-283 7075-T6 .016 x 3.70 x 4.10	31	045
					~~4~~	~~-47~~				~~QQ-A-283 7075-T6 .016 x 4.80 x 8.40~~		044
			4	4	4	-45				QQ-A-283 7075-T6 .016 x 1.00 x 1.67	6	043
			2	2	10	-43				QQ-A-283 7075-T6 .016 x 2.00 x 2.00	8	042
			2	2	2	-41				QQ-A-283 7075-T6 .016 x .70 x 3.10	8	041
			6	6	6	-39				QQ-A-283 7075-T6 .016 x 1.05 x 1.75	7	040
			1	1	1	-37				QQ-A-283 7075-T6 .020 x 4.60 x 9.60	6	039
			1	1	1	-35				QQ-A-283 7075-T6 .063 x 3.50 x 9.60	6	038
			1	1	1	-33				QQ-A-283 7075-T6 .063 x 2.00 x 7.62	6	037
			1	1	1	-31				QQ-A-283 7075-T6 .020 x 2.00 x 7.62	6	036
			4	6	6	-29				QQ-A-283 7075-T6 .016 x 2.50 x 2.50	7	035
			2	2	2	-27				QQ-A-283 7075-T6 .016 x 1.15 x 2.31	8	034
			1	1	1	-25				QQ-A-283 7075-T6 .016 x 2.00 x 3.00	8	033
			4	4	4	-23				QQ-A-283 7075-T6 .020 x 2.50 x 4.68	8	032
				~~[struck out]~~		~~-21~~				~~[struck out]~~	~~9~~	031
				~~[struck out]~~		~~-19~~				~~[struck out]~~	~~8~~	030
				~~[struck out]~~		~~-17~~				~~[struck out]~~		029
				~~[struck out]~~		~~-15~~				~~[struck out]~~	9	028
			1	1	1	-13				QQ-A-283 7075-T6 .020 x 3.80 x 3.80	30	027
			1	1	1	-11				QQ-A-283 7075-T6 .016 x 1.00 x 2.13	26	026
			2	2	2	-9				QQ-A-283 7075-T6 .016 x 6.80 x 7.80	26	025
			8	8	8	-7				QQ-A-283 7075-T6 .016 x .93 x 1.25	20	024
			5	5	5	-5				QQ-A-283 7075-T6 .016 x 2.47 x 3.95	16	023
			4	4	4	-3	DBLR		ALUM ALLOY SHT	QQ-A-283 7075-T6 .020 x 7.20 x 7.20	15	022
(4)			114	90	114	CKL-P4B	BLIND RIVET					021
(4)			8	8	8	CKL-P4F	BLIND RIVET					020
(5)			18	18	18	SN10F-15-A	SPACER					019
(5)			18	18	18	SNG10F-1-A	GROMMET					018
			4		4	V17-331780	SUPPORT				17	017
			52	52	84	NAS1398D4-2	RIVET				6	016
			26	26	42	V17-320202-7	SPACER				7/8	015
			1	1	1	V17-331763	SUPPORT				8	014
			4	4	4	V17-331755	SUPPORT				15/20	013
			5	5	5	V17-331672-21	BRACKET				7	012
			4	4	4	V17-331593	BRACKET				35/29	011
			2	2	2	V17-331752	SUPPORT				26	010
			4	4	4	V17-331586	BRACKET				16	009
			3	3	3	V17-331582					7	008
			1	1	1	V17-331579					6	007
			2	2	2	V17-331571-11					8	006
			1	1	1	V17-331570-11					8	005
			2	2	2	V17-331569-11					8	004
			1	1	1	V17-331564-11					8	003
			1	1	1	V17-331563-21	BRACKET				6	002
						V17-331717	ASSY					001

LIST OF MATERIAL OR PARTS LIST

9. NO ITEM ON THIS DWG REQ TRACEABILITY
(5) 8. MAY BE PURCHASED FROM SHUR-LOK CORP ANAHEIM CALIF
7. STD DETAILS PER MA0102-002
(4) 6. MAY BE PURCHASED FROM HUCK MFG CO LOS ANGELES, CALIF
5. BOND DBLRS PER LA0106-008 EXCEPT USE 7 PARTS BY WEIGHT OF DTA INSTEAD OF APCO-320 AND CURE FOR 24 HOURS AT ROOM TEMP
(3) 4. APPLY TYPE I FILLER ON ALL EXPOSED EDGES AROUND CUTOUT PER LA0106-008, EXCEPT USE 7 PARTS BY WEIGHT OF DTA INSTEAD OF APCO-320 AND CURE FOR 24 HOURS AT ROOM TEMP
(2) 3. ITEM TO BE MOUNTED ON NEARSIDE OF BHD 355.0
(1) 2. ITEM TO BE MOUNTED ON FARSIDE OF BHD 355.0
1. INSTALL RIVETS PER MA0101-006

NOTES: UNLESS OTHERWISE SPECIFIED

ITEM	QTY	MODEL	NEXT USING DRAWING	END ITEM NO.	THRU
E201	1	V17-3	V17-000002	8	-
BASIC	1	V17-2	V17-000002	12	-
E101	1	V17-3	V17-000002	1	-
BASIC	1	V17-3	V17-000002	2,4,6,7,10,12 & 14	-

REQD PER END ITEM — EFFECTIVE ON
APPLICATION (USAGE) DATA

HEAT TREAT
FINISH V14-000024

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ON: DECIMALS .XX ± .03 .XXX ± .010; ANGLES ± 30'; HOLES NOTED "DRILL"
DO NOT SCALE PRINT

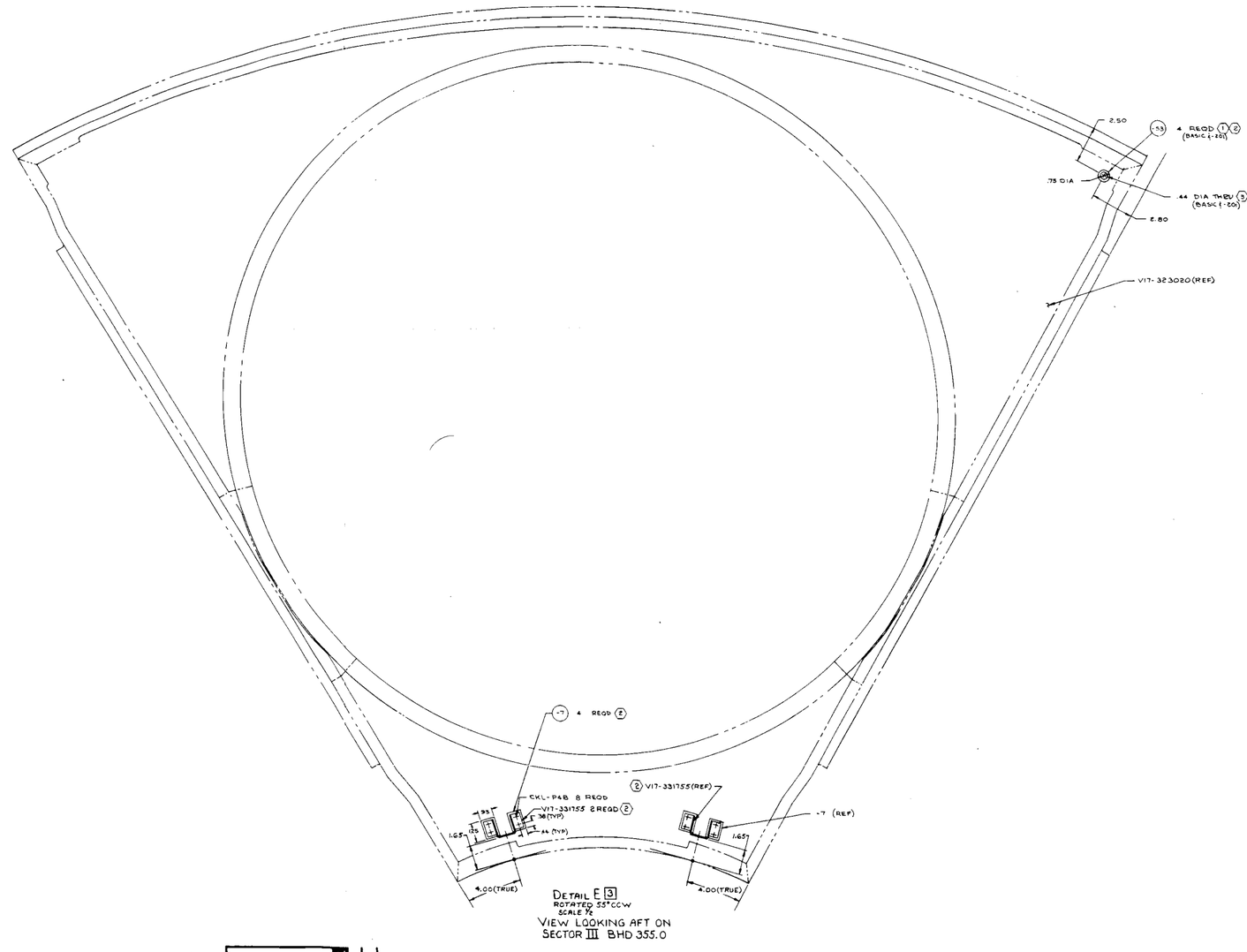
DR BY S. JOYLES 7-15-63
CHK BY
APPROVED BY

NORTH AMERICAN AVIATION, INC. SPACE and INFORMATION SYSTEMS DIVISION 12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

MOUNTING PROVISIONS — COMPONENT, BHD 355.0, ASSY OF

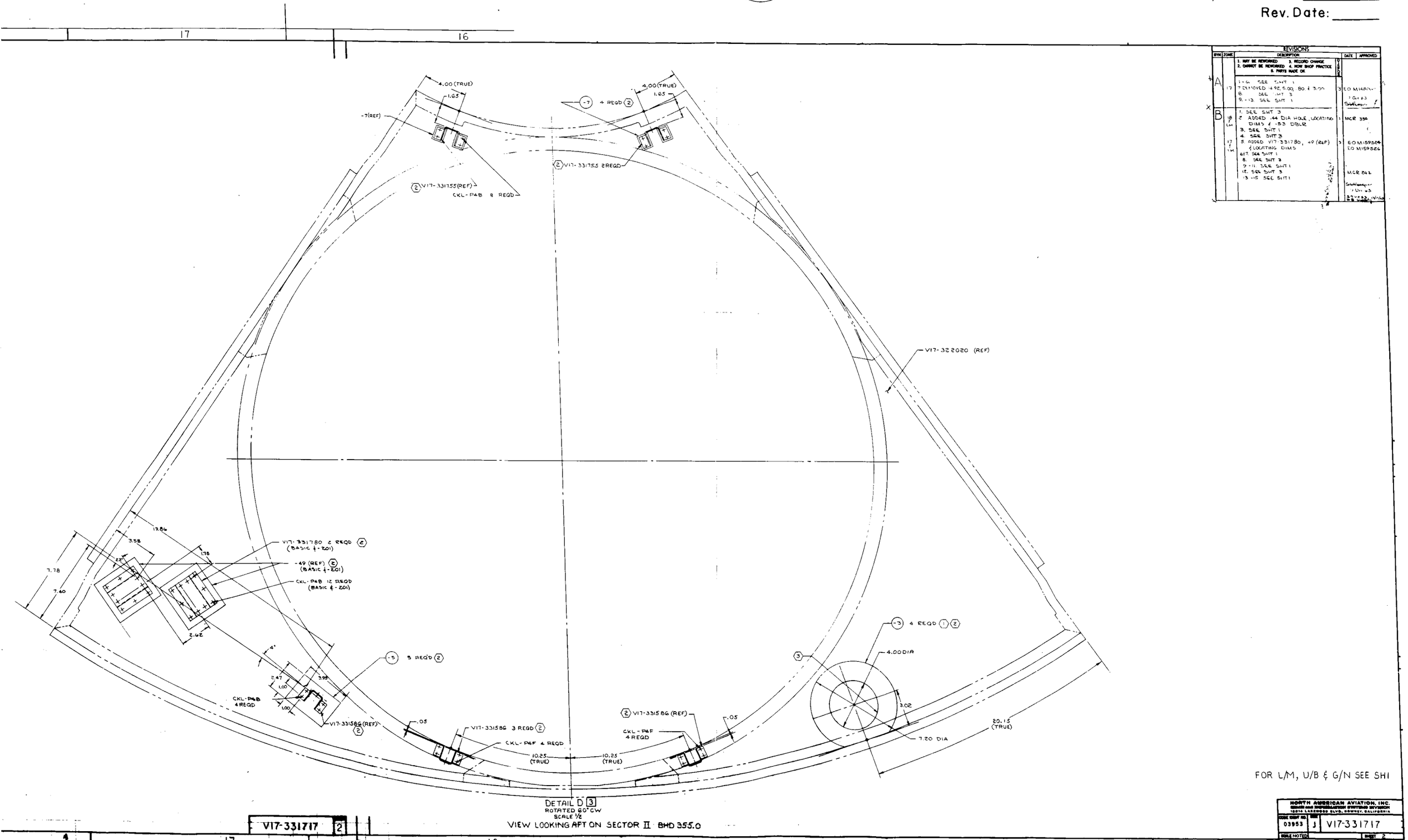
CODE IDENT NO. 03953 | SIZE J | V17-331717
SCALE NOTED | SHEET 1 OF 3

Figure 5-1. Mounting Provisions, Environmental Control System Installations (V17-331717-1)



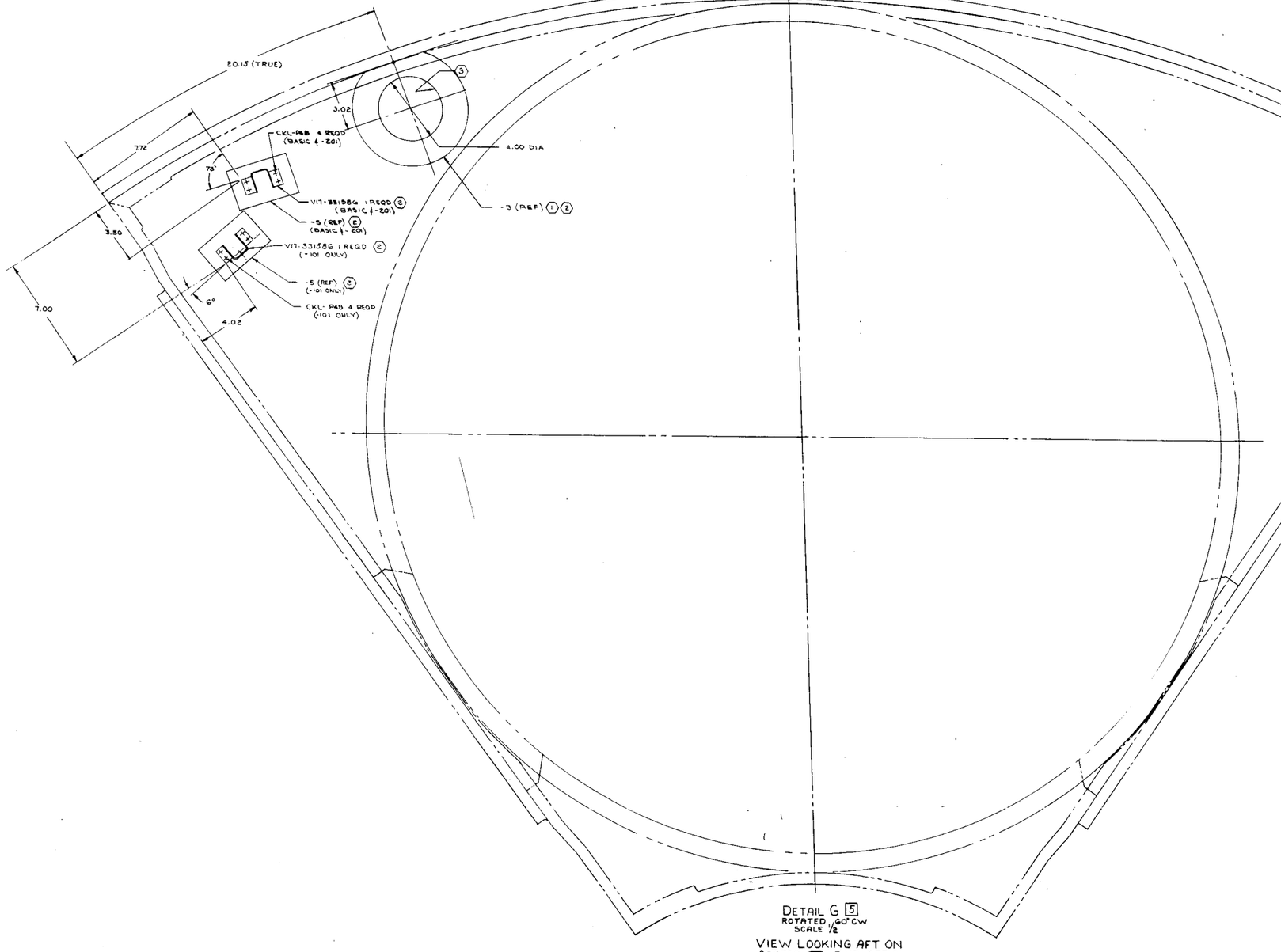
DETAIL E [3]
ROTATED 55°CCW
SCALE ½
VIEW LOOKING AFT ON
SECTOR III BHD 355.0

24 23 22 21 20 19 18



SYM	ZONE	DESCRIPTION	DATE	APPROVED
		1. MAY BE REWORKED 3. RECORD CHANGE 2. CANNOT BE REWORKED 4. NOW SHOP PRACTICE 5. PARTS MADE OK		
A	17	1-6 SEE SHT 1 7 REMOVED (-92, 5.00, 80 & 3.00) 8 SEE SHT 3 9-13 SEE SHT 1	3	EO M1589...
B	18 L/M	1. SEE SHT 3 2. ADDED .44 DIA HOLE, LOCATING DIMS & -53 DBLR 3. SEE SHT 1 4. SEE SHT 3	1	MCR 356
	17 L/M	5. ADDED V17-331780, 49 (REF) & LOCATING DIMS 6&7 SEE SHT 1 8. SEE SHT 3 9-11 SEE SHT 1 12. SEE SHT 3 13-15 SEE SHT 1	3	EO M1589... EO M1589... MCR 242

Figure 5-2. Mounting Provisions, Environmental Control System Installations (V17-331717-2)



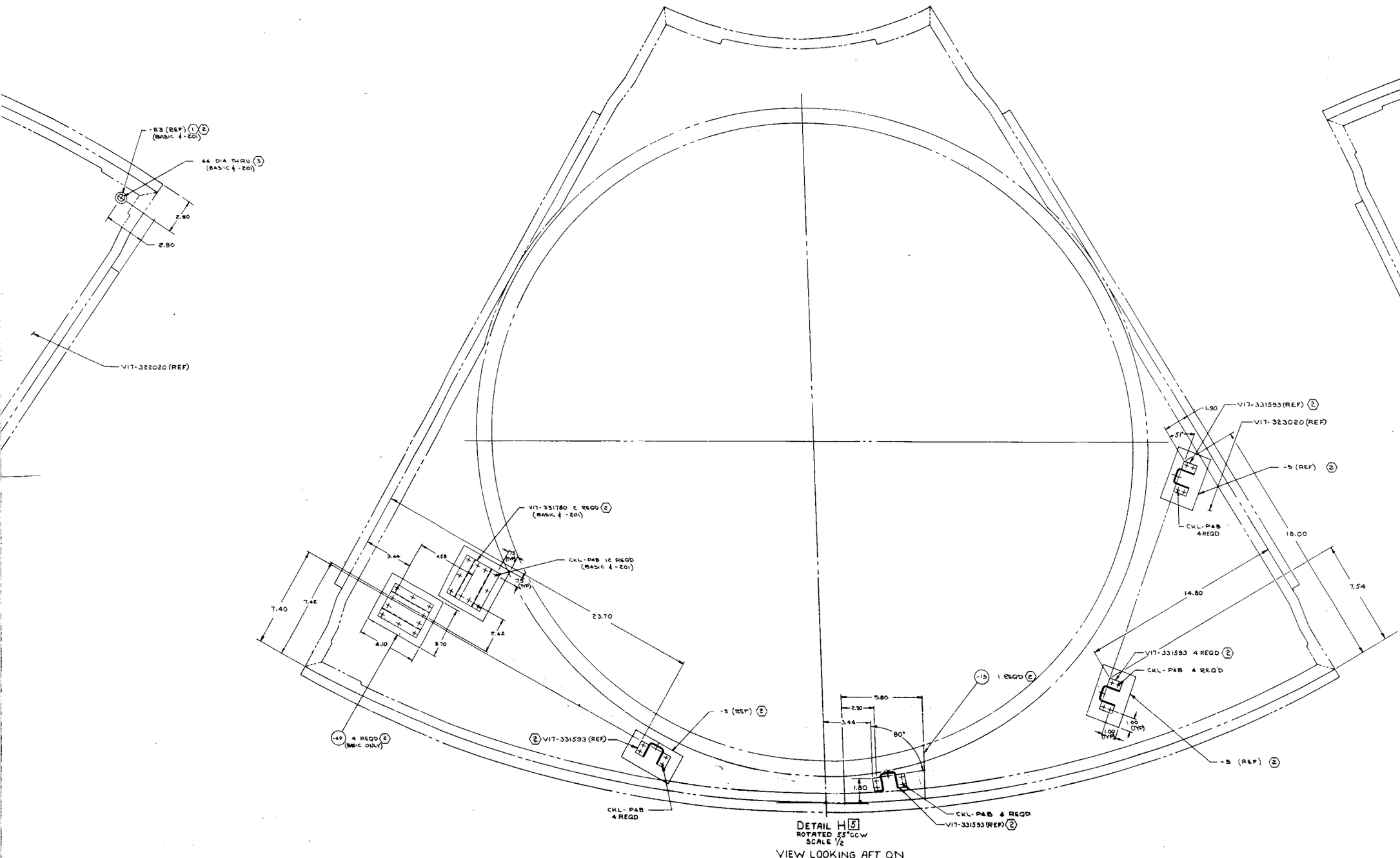
DETAIL G [5]
ROTATED 60° CW
SCALE 1/2

VIEW LOOKING AFT ON
SECTOR V BHD 355.0

36 35 34 33

2

32 | 31 | 30 | 29 | 28



DETAIL H [5]
ROTATED 55° CCW
SCALE 1/2

VIEW LOOKING AFT ON
SECTOR VI BHD 355.0

V17-331717 [3]

32 | 31 | 30 | 29 | 28

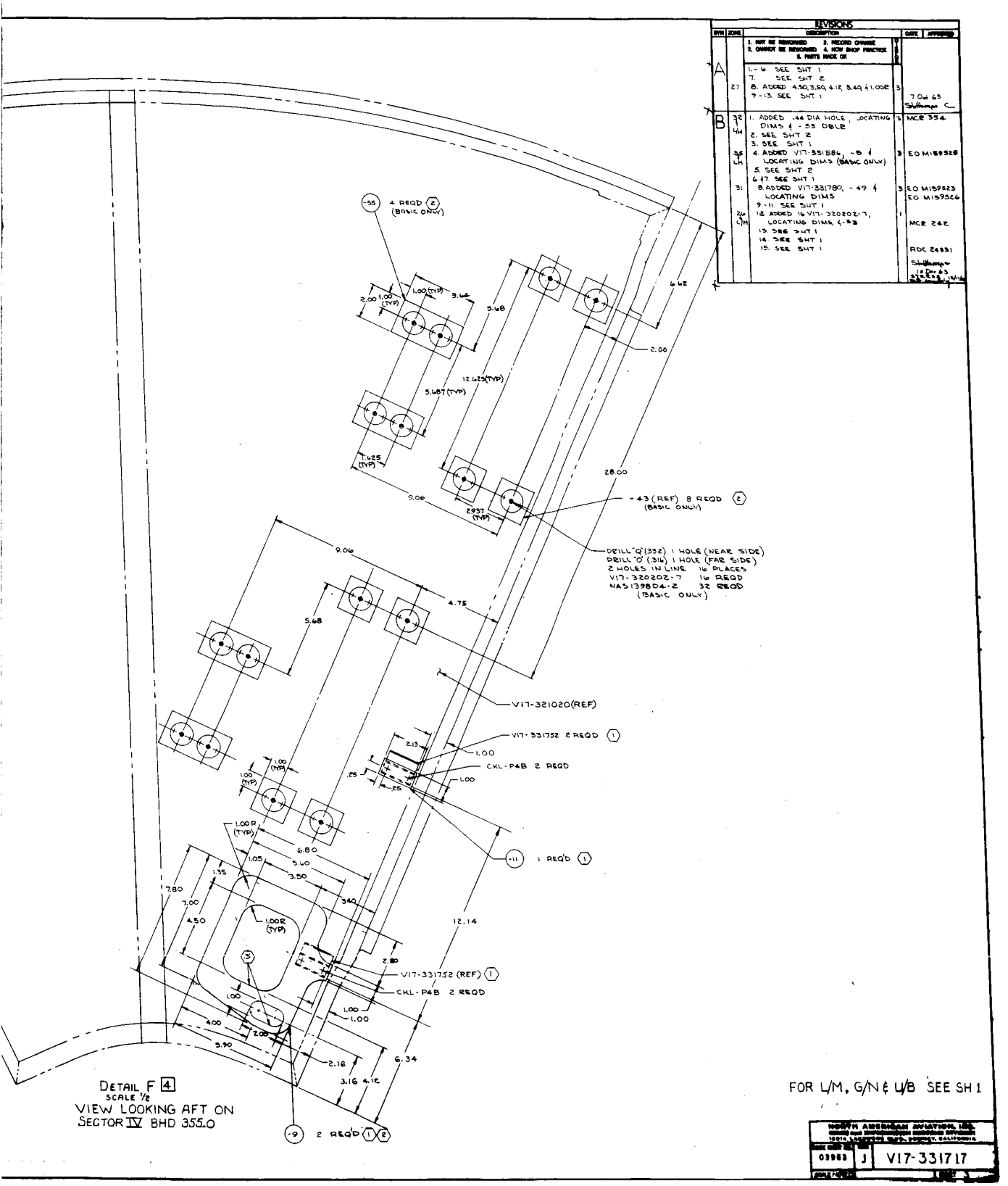
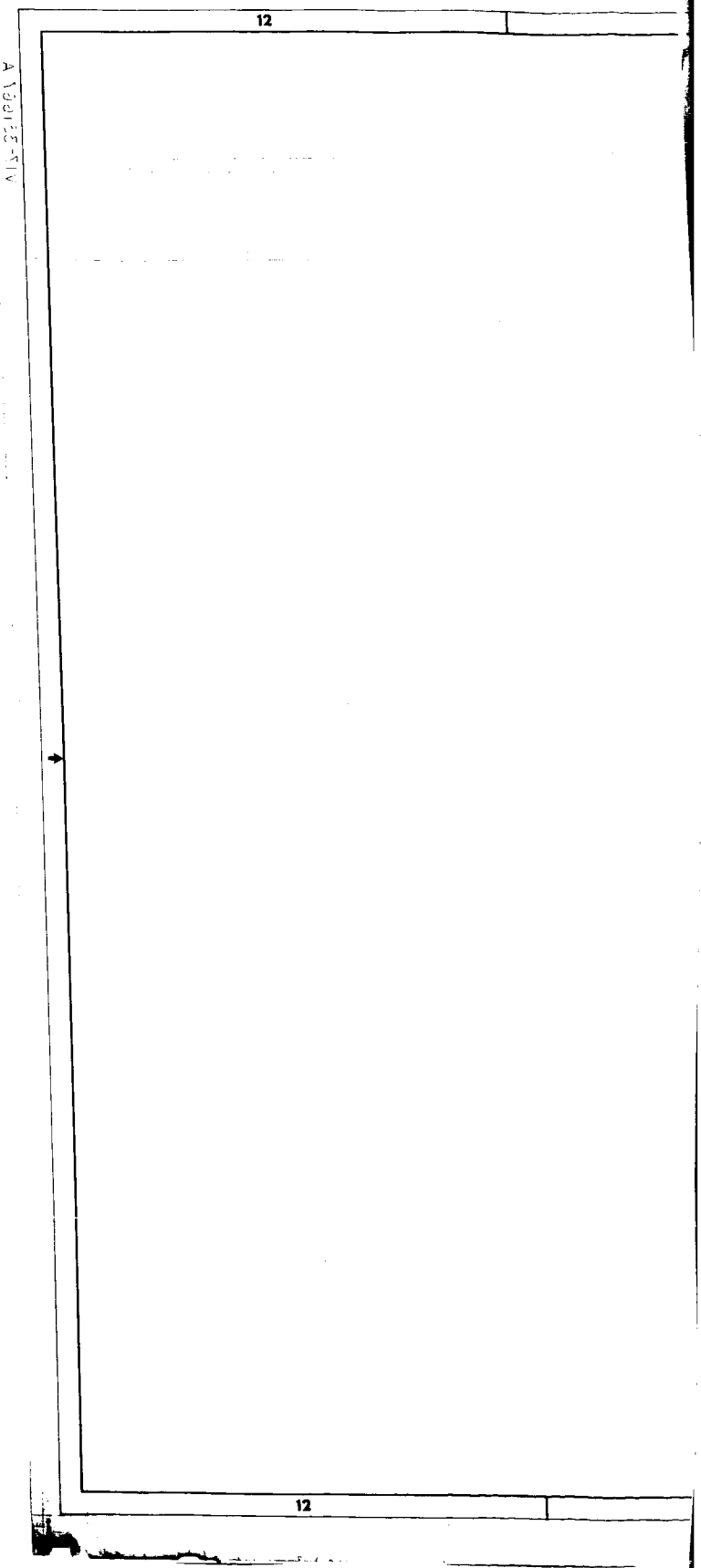
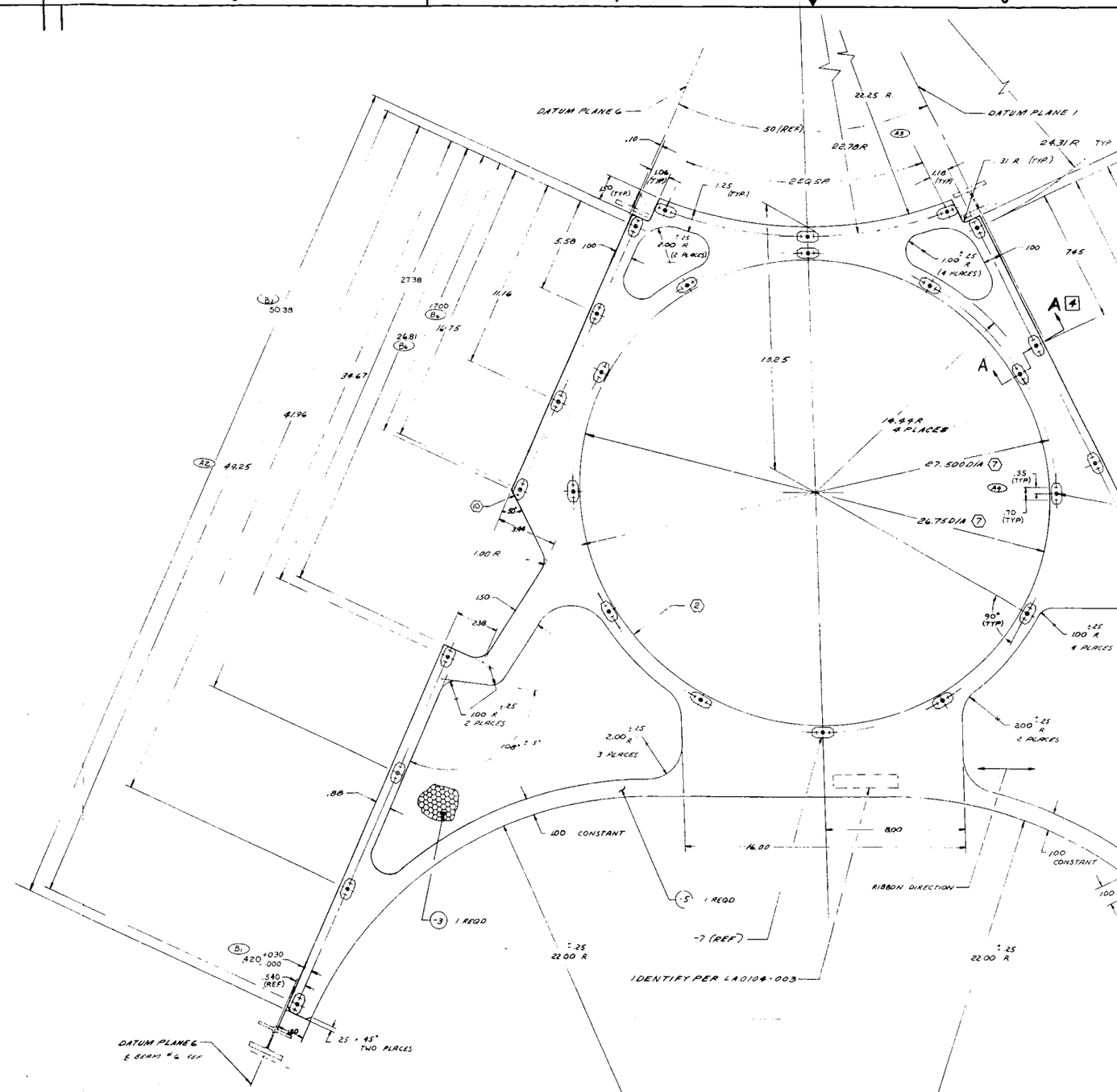


Figure 5-3. Mounting Provisions, Environmental Control System Installations (V17-331717-3)


12
12

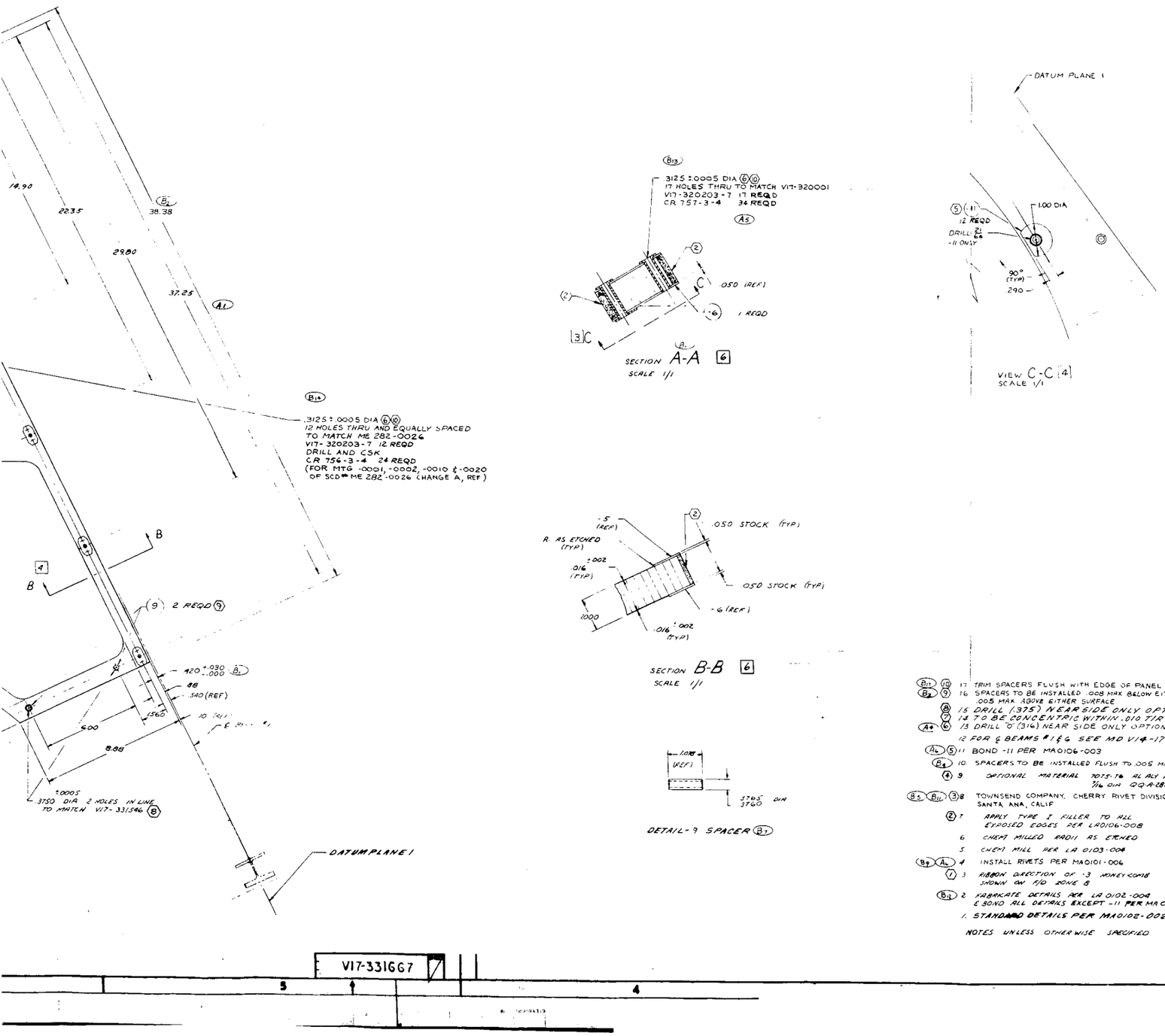
2

11 10 9 8 7 6



V17-331GG7

11 10 9 8 7 6



17 TRIM SPACERS FLUSH WITH EDGE OF PANEL AFTER ASSY
16 SPACERS TO BE INSTALLED .008 MAX BELOW EITHER SURFACE TO .005 MAX ABOVE EITHER SURFACE
15 DRILL (.375) NEAR SIDE ONLY OPTIONAL 2 HOLES
14 TO BE CONCENTRIC WITHIN .010 TIR
13 DRILL "O" (.316) NEAR SIDE ONLY OPTIONAL 29 HOLES
12 FOR ℄ BEAMS #1 & 6 SEE MD V14-17
11 BOND -11 PER MA0106-003
10 SPACERS TO BE INSTALLED FLUSH TO .005 MAX PROTRUSION
9 OPTIONAL MATERIAL 7075-T6 AL ALY AMS 4078 1/16 DIA QQ-A-282 OR QQ-A-277
8 TOWNSEND COMPANY, CHERRY RIVET DIVISION SANTA ANA, CALIF
7 APPLY TYPE I FILLER TO ALL EXPOSED EDGES PER LA0106-008
6 CHEM MILLED RADII AS ETCHED
5 CHEM MILL PER LA 0103-004
4 INSTALL RIVETS PER MA0101-006
3 RIBBON DIRECTION OF -3 HONEYCOMB SHOWN ON F/D ZONE B
2 FABRICATE DETAILS PER LA 0102-004 & BOND ALL DETAILS EXCEPT -11 PER MA 0106-033
1 STANDARD DETAILS PER MA0102-002

NOTES UNLESS OTHERWISE SPECIFIED

REVISIONS

SYM	ZONE	DESCRIPTION	DATE	APPROVED
B	G/N	11. REMOVE G/N "OPTIONAL MATERIAL..."		3
	G/N	12. REVISED G/N 2 "FABRICATE ..... ALL DETAILS EXCEPT -11 PER ____" TO "FABRICATE ..... ALL DETAILS PER..."		3
	4	13. HOLE CALLOUT WAS .325 ±.0005 DIA 17 HOLES IN LINE TO MATCH V17-320001		2
	5	14. HOLE CALLOUT WAS .325 ±.0005 DIA 12 HOLES EQUALLY SPACED AND LOCATED WITHIN .010 DIA OF TRUE POSITION		3
	L/M	15. ADDED V17-320203-7 CR 756-3-4, & CR 757-3-4		3
	G/N	16. G/N 2 MA 0106-033 WAS MA0106-002		3
		17. ADDED G/N 17 "TRIM SPACERS..... EFFECT ON ITEM 4,7,8,15 & 17 V17-2 12 V17-3 1,2,4,6,7&8	W. Pellingham 10-22-63	1

REVISIONS

SYM	ZONE	DESCRIPTION	DATE	APPROVED
		1. MAY BE REWORKED 3. RECORD CHANGE 2. CANNOT BE REWORKED 4. NOW SHOP PRACTICE 5. PARTS MADE OK		
A	5	1. REMOVED DIMS: 3.72, 11.16, 10.62, 26.08, 33.52 & 39.35, 13.40, 30.50, 36.75, 43.00, 46.12		E0185232
	6	2. 5.58, 11.16, 39.67, 41.96 WAS 6.70, 10.05, 33.62 & 39.87, RESPECTIVELY		E0185232
	6-7	3. ADDED .22 TYP R .24 TYP R .18 (TYP)		
	6-7	4. ADDED 26.75 DIA, 27.50 DIM & 15.25 DIM. G/N 13 & 14		E0125485 IN PART
	4	5. 29 REQD WAS 30 REQD		
		6. REMOVED G/N 9 "IDENTIFY PER ____ & G/N 11 "TRIM."		
	6	7. ADDED REQT'D TO ASSEMBLY DWG BLOCK, V17-2 BILL		
		8. ADDED G/N 15 EFFECT ON ITEM 4 & 8 V17-2 12 V17-3 1,2,4,6,7&8		DME GONZALES 7-9-63
B	4,6 1,5	1. REVISED SECT A-A REMOVED .440 (REF), .420 +.030 -.000 (TYP) WAS .410 (REF), .540 (REF) WAS .540		EOM 14390
	5&8	2. ADDED 38.38 DIM & 30.38 DIM		EOM 14014
	1/8	3. V17-331547 WAS B17-300027 FOR MODEL V17-2 END ITEM 12 ADDED G/N 16 "SPACERS TO BE		EOM 11805
	G/N	4. ADDED G/N 10 WAS REMOVED PER ECO		SUPERSEDES EOM 11805 IN PART
	G/N	5. ADDED G/N 8 "TOWNSEND CO....."		
	8	6. ADDED MISSING DIM 1.00 & 2.81		
	L/M 4	7. REMOVED DETAIL -1		
	L/M 3	8. ADDED DETAIL -11		
	G/N	9. ADDED G/N 4 "INSTALL RIVETS PER..."		
		10. ADDED G/N 11 "BOND -11 PER ....."		

QTY REQD	QTY REQD	QTY REQD	QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT	MATERIAL	DATA: SPECIFICATION, SIZES, NOTES, SUPPLIERS	ZONE	LINE NO.
				V17-331667	ASSY OF					001
			1	-3	CORE		AL ALLOY HONEYCOMB 5052 N 39	HEXCEL 3/16-5052-.004A 1.00 x 47.12 x 51.50	B	002
			1	-5	FACING SHEET		AL ALLOY SHEET 7178-T6	.050 x 47.12 x 51.50	E	003
			1	-6	FACING SHEET		AL ALLOY SHEET	.040 x 47.12 x 51.50	E	004
			1	-7	SHIMMER			~~MAKE FROM .040 AL ALLOY SHEET~~ MAKE FROM .080 AL ALLOY SHEET	E	005
			29	-9	SPACER			~~MAKE FROM .040 AL ALLOY SHEET~~ MAKE FROM .080 AL ALLOY SHEET	E	006
			2	-9	SPACER			MAKE FROM WAS .040 AL ALLOY SHEET	E	006
			12	-11	WASHER			.004 x .375 DIA x .032 AL ALLOY SHEET	E	007
			34	CR 757-3-4	CHERRY RIVET			(3)		008
			24	CR 756-3-4	CHERRY RIVET			(3)		009
			29	V17 320203-7	SPACER					010
			12	-11	WASHER			.004 x .375 DIA x .032 AL ALLOY SHEET	E	007
			2	-9	SPACER			MAKE FROM WAS .040 AL ALLOY SHEET	E	006
			29	-7	SHIMMER			~~MAKE FROM .040 AL ALLOY SHEET~~ MAKE FROM .080 AL ALLOY SHEET	E	005
			1	-6	FACING SHEET		AL ALLOY SHEET	.040 x 47.12 x 51.50	E	004
			1	-5	FACING SHEET		AL ALLOY SHEET 7178-T6	.050 x 47.12 x 51.50	E	003
			1	-3	CORE		AL ALLOY HONEYCOMB 5052 N 39	HEXCEL 3/16-5052-.004A 1.00 x 47.12 x 51.50	B	002
				V17-331667	ASSY OF				E	001

LIST OF MATERIAL OR PARTS LIST

B3	BASIC	2	V17-2	V17-331547	12	—	
	BASIC	2	V17-3	V17-331547	1,2,4,6	8	
	ITEM REQD PER END ITEM	QTY	MODEL	NEXT USING DRAWING	END ITEM NO. EFFECTIVE ON	THRU	

APPLICATION (USAGE) DATA

HEAT TREAT

FINISH V14-000024

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ON: DECIMALS .XX± .03, .XXX± .010; ANGLES ± 30'; HOLES NOTED "DRILL" .053 THRU .040 +.001 -.003, .041 THRU .130 +.002 -.003, .131 THRU .289 +.003 -.003, .290 THRU .500 +.004 -.003, .501 THRU .750 +.005 -.003, .751 THRU 1.000 +.007 -.003, 1.001 THRU 2.000 +.010 -.003

DO NOT SCALE PRINT

DR BY S.S. MATUS 4-8-63
CHK BY
4/15/63 APPROVED BY F.J. Conte

NORTH AMERICAN AVIATION, INC. SPACE and INFORMATION SYSTEMS DIVISION 12214 LAKEWOOD BLVD. DOWNEY, CALIFORNIA

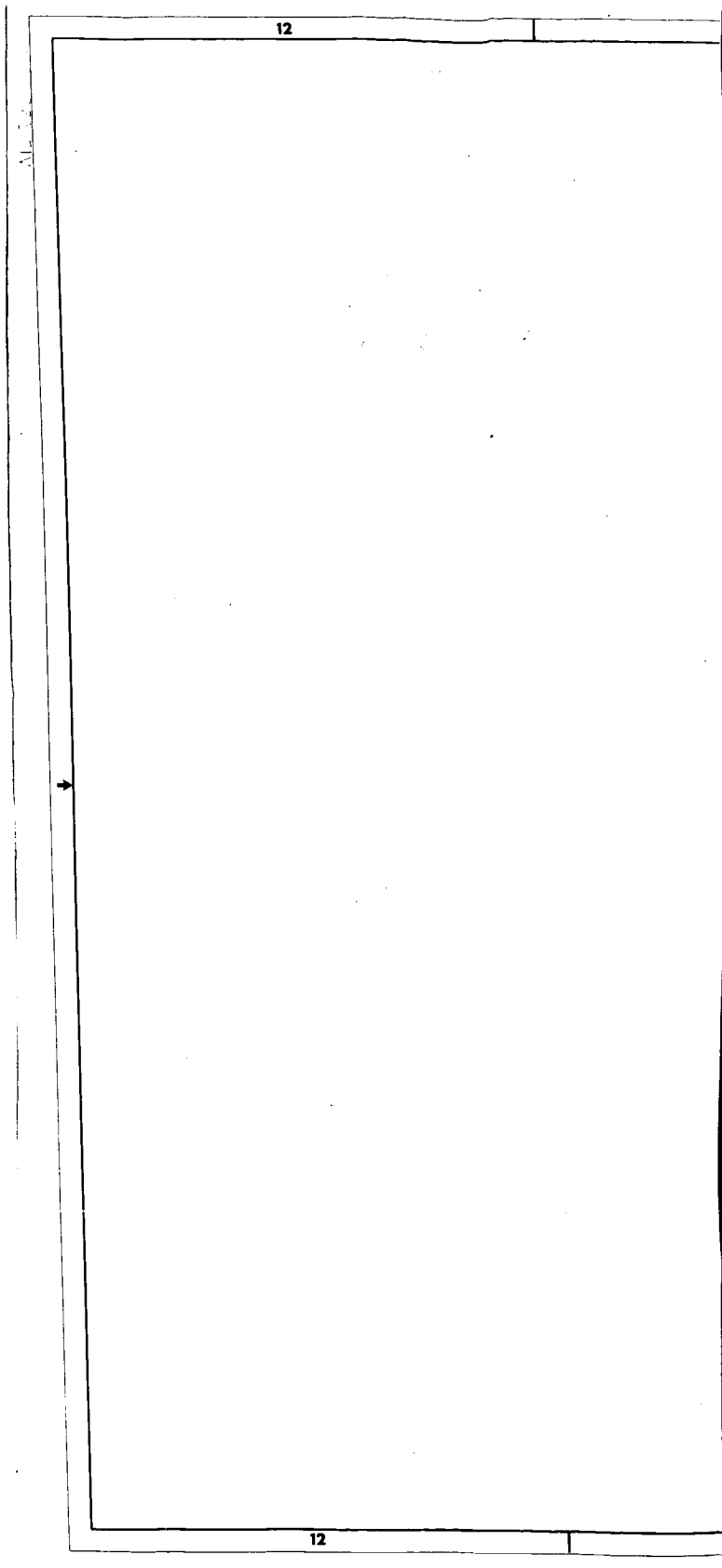
SHELF-OXYGEN TANK SUPPORT, ASSEMBLY OF

CODE IDENT NO. 03953 SIZE J V17-331667

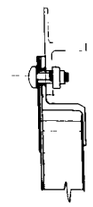
SCALE 1/4 SHEET

V17-331667

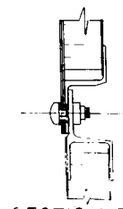
Figure 5-4. Assembly of Oxygen Tank Shelf Support (V17-331667)


12
12

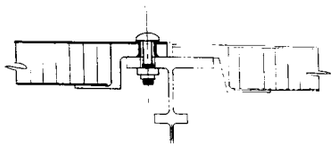
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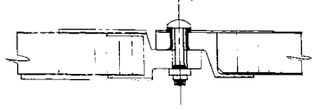
SECTION E-E [6]
SCALE: 1/1



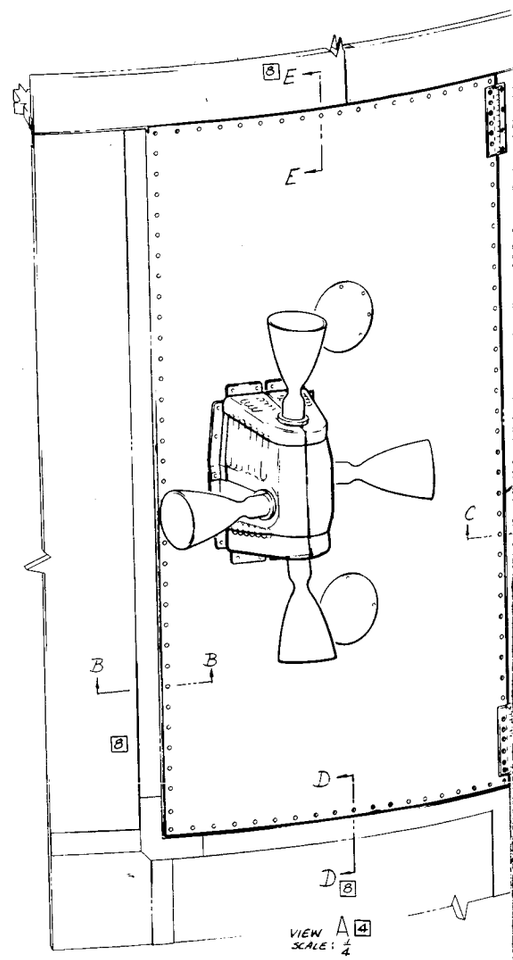
SECTION D-D [6]
SCALE: 1/1



SECTION C-C [6]
SCALE: 1/1



SECTION B-B [6]
SCALE: 1/1



VIEW A [4]
SCALE: 1/4

V17-332000

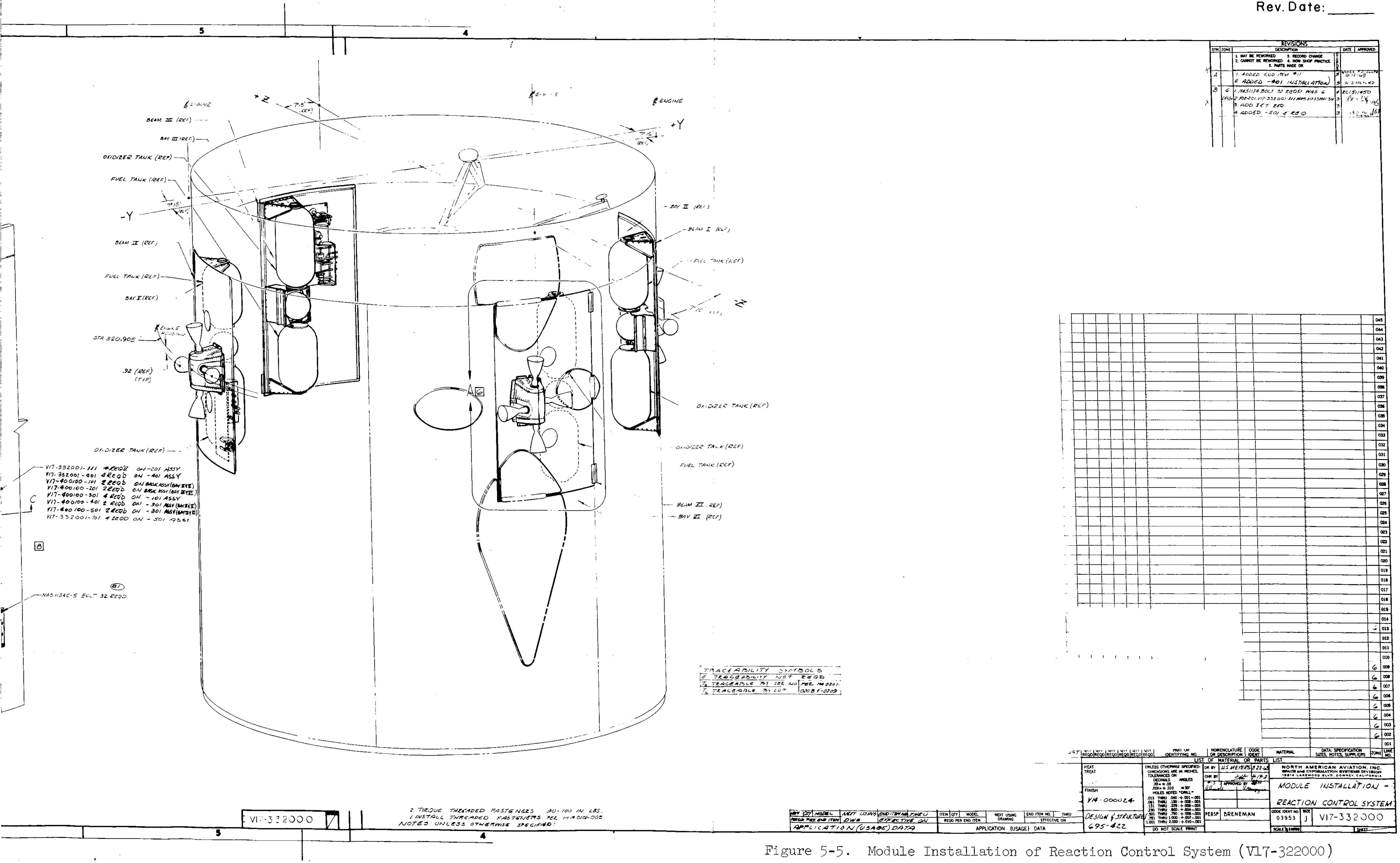


Figure 5-5. Module Installation of Reaction Control System (V17-322000)

Complete Reaction Control System" (Figures 5-6 through 5-7) show the over-all configuration of the RCS mounting provisions. Drawing V17-332002 (Figures 5-8 through 5-9) gives details of the panel per se.

5.3.2 The housing assembly of the RCS is shown in drawing V17-332010 (Figure 5-10). Brackets are used for mounting the assembly.

5.3.3 The engines of the RCS are supported on panels which form part of the outer shell of the S/M. Hinges, attached by screws to the shell, allow the RCS panels to be swung out for access or replacement.

5.3.4 Heat shields which protect the outer shell of the S/M from RCS-engine-flame impingement are shown, with their mountings, in two drawings: V17-331525 (Figure 5-11) for the longitudinal installation, and V17-331611 (Figure 5-12) for the lateral installation. The insulation for the RCS panels is depicted in drawing V17-332046 (Figure 5-13).

5.3.5 The RCS engine installation requires a cluster of three tanks in each of its four locations. The complete assembly of the fuel, oxidizer, and pressurant tanks which are mounted as a cluster is exhibited in drawings V17-332041 (Figure 5-14) and V17-332042 (Figure 5-15).

5.3.6 Mounting of valves for the RCS is done by brackets and a panel.

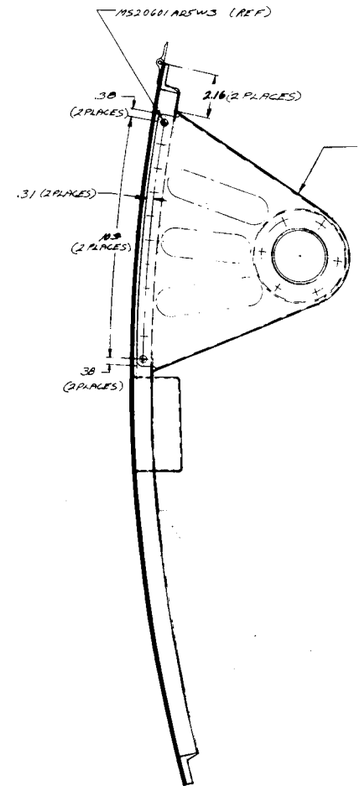
5.3.7 Mounting of the RCS control unit has not been designed yet.

5.4 SPS Mounting Provisions Configuration

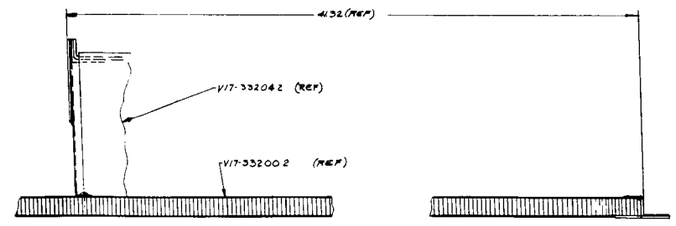
5.4.1 Drawing V17-327101, "Installation of Engine Mount, Service Propulsion System" (Figures 5-16 through 5-17), breaks down the mounting provisions for the SPS main engine.

5.4.2 A propellant distribution system of valving, hard lines, and electrical harnesses carry fuel and electricity to the SPS main engine. Drawing V17-331000 (Figure 5-18) depicts mounting provisions for this distribution system.

5.4.3 Support provisions for the pressurization system which assures a constant flow of fuel and oxidizer to the main engine are shown in drawing V17-331100 (Figure 5-19). Included in these provisions are a control panel, line supports, and mounting brackets. Drawings V17-331101 and V17-331102 which exhibit supports for the panel assembly of the pressurization-system module are not available and therefore not included.



SCALE: 1/2



SECT D-D (B4) (6)
SCALE: 1/2

2

8 7 6 5 4

V17-332015-2 (REF)

CA1137-2-14 25 REQD
SEE SECTION C-C ZONE B

V17-332013 2 REQD
NAS1133C1 16 REQD
LD153-0002-2203 16 REQD
(ON-501 ONLY)

V17-33161I-21 1 REQD

V17-332042 1 REQD (ON-501, -701, -801, & -901)
V17-332042-31 1 REQD (ON-501)
DRILL #10 (.193) DIA 14 HOLES THRU
V17-332042 (LOCATE FROM INSERTS
IN V17-332002 PANEL)
NAS1133C1 14 REQD
LD153-0002-2203 14 REQD
(MOUNTING FLANGES ONLY SHOWN)

V17-332015-1 1 REQD
V17-332015-2 1 REQD
NAS1133C1 6 REQD
LD153-0002-2203 6 REQD

V17-332041-1 1 REQD
V17-332041-2 1 REQD
DRILL #10 (.193) DIA 12 HOL
V17-332041 (LOCATE FRO
IN V17-332002 PANEL)
NAS1133C1 12 REQD
LD153-0002-2203 12 REQD
MS 20601AD5W3 22 REQD
DRILL Ø C'SINK
(ON-501, -701, -801, & -90

V17-332041-2 (REF)

V17-332041-2 (REF)

V17-332013 (REF)

11/32

A

D

B

V17-332042 (REF)

V17-332056 (REF)

V17-332050 (REF)

C

C

CA1137-1-11 19 REQD

CA1137-1-11 18 REQD
SEE SECTION C-C ZONE B

UPSET CA1139 SERIES FASTENERS
INTO COUNTERBORE, AS SHOWN
TOOL CA1137-798 MAY BE USED
(CALPAX, INC EL SEGUNDO, CALIF)

V17-331525-21 1 REQD

V17-332056 1 REQD
V17-332055-9 4 REQD
LD153-0001R-2203 4 REQD
NAS1133C1 4 REQD
(ON-501, -701, -801, & -901)

V17-332010 (REF)

V17-331525-21
(REF)

CA1137-3-19 33 REQD
SEE SECTION C-C ZONE B

SECTION C-C 7
SCALE 2/1

SECTION
SCALE: 1/2

VIEW LOOKING OUTBD
SCALE: 1/2

TRACEABILITY SYMBOLS	
T TRACEABILITY NOT REQD	
T1 TRACEABILITY BY SER NO.	MA 020
T2 TRACEABILITY BY LOT NO.	MA 020

4. INSTALL RIVETS PER MA 0101-006.
3. INSTALL THREADED FASTNERS
PER MA 0101-006
2. IDENTIFY PER CA1004-883 SELECT
DO NOT USE IMPRESSION STAMP.
1. ALL DIMENSIONS ARE TRUE.
NOTES: UNLESS OTHERWISE SPECIFIED

V17-332001 1

8 7 6

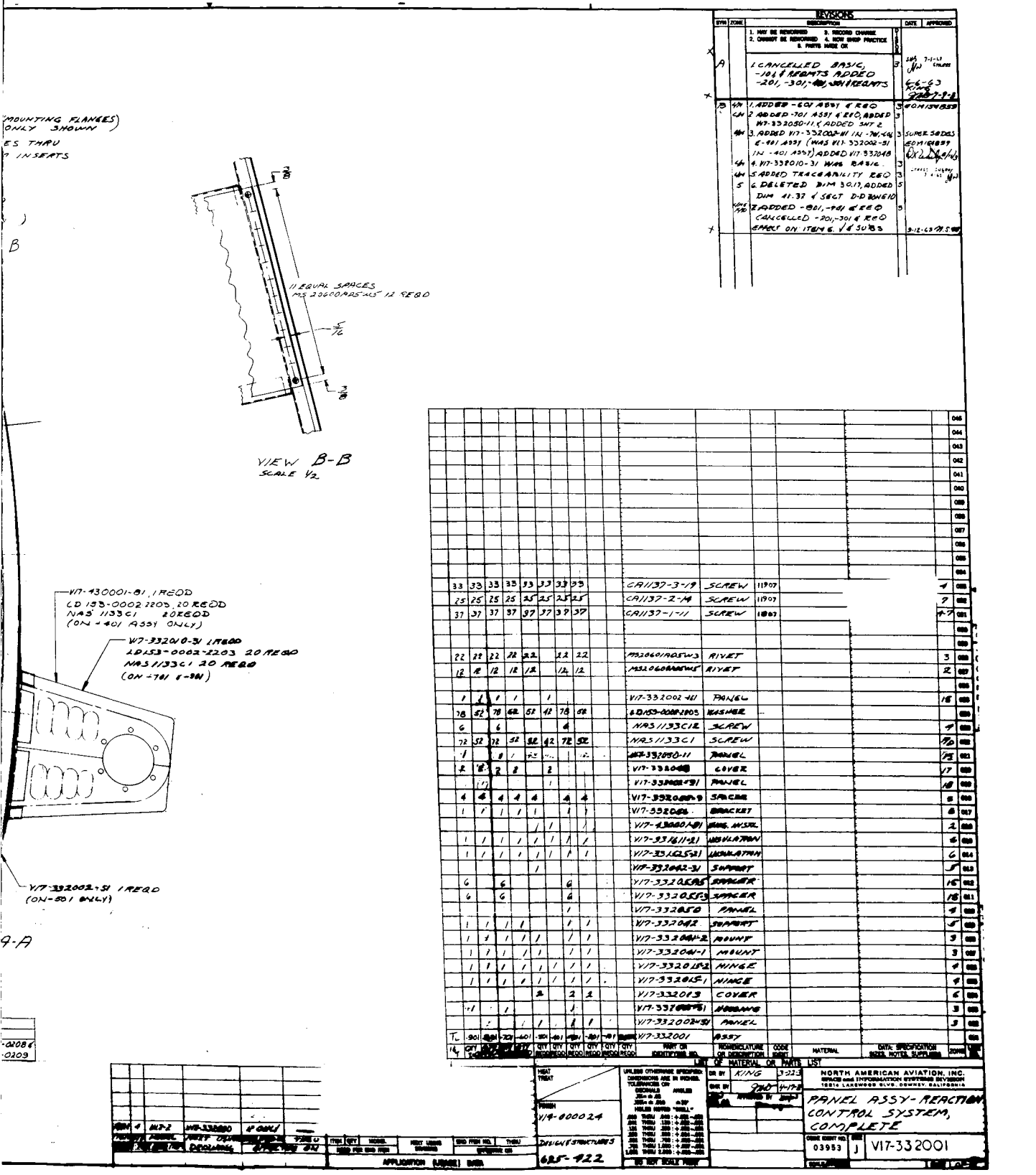
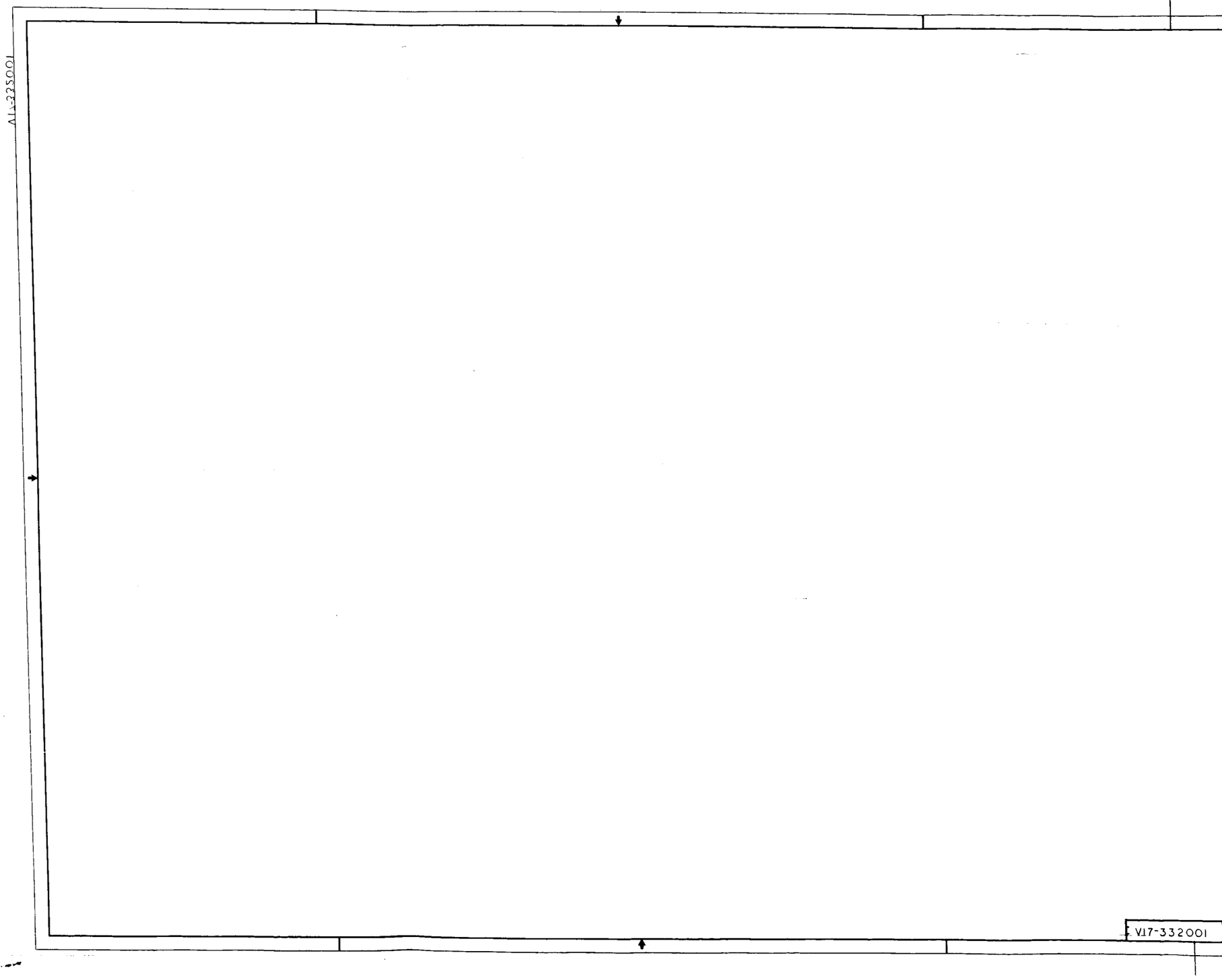
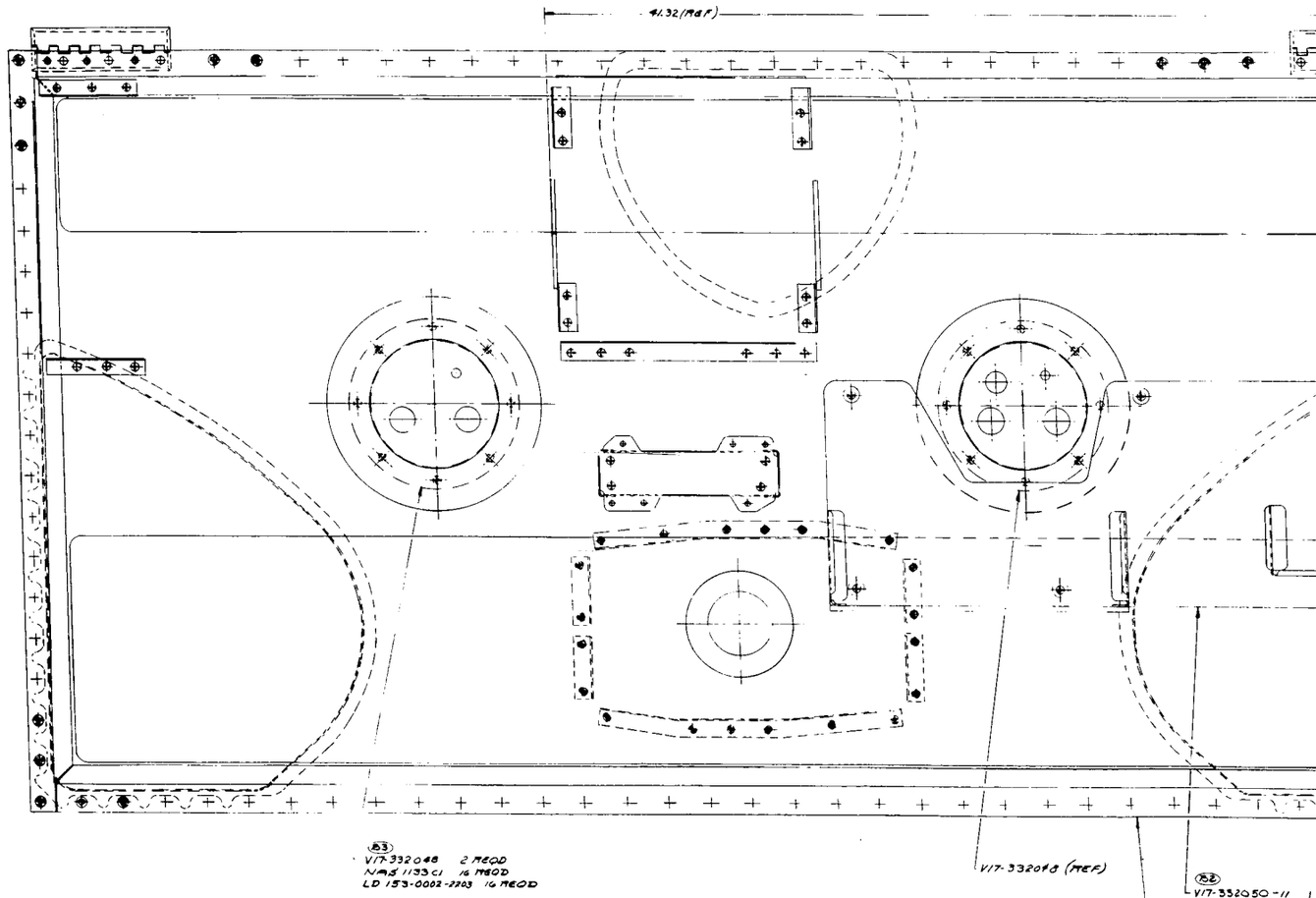


Figure 5-6. Panel Assembly Complete, Reaction Control System (V17-332001-1)


V17-332001
V17-332001

2

19 18 17 16



DETAIL-401, -601, -701, -801 & -701
SAME AS -501 EXCEPT AS NOTED
VIEW IS LOOKING OUTBOARD
SCALE: 1/2

2 19 18 17 V17-332001 2 16

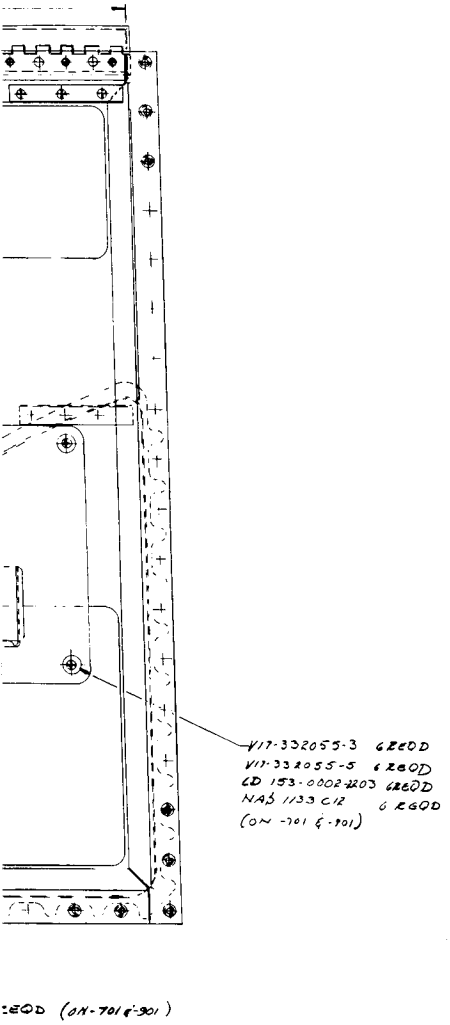


Figure 5-7. Panel Assembly Complete, Reaction Control System (V17-332001-2)

12 11 10 9 8

DRILL .5625 DIA 6 HOLES TO MATCH V17-332001 & V17-332015

DRILL .5625 DIA 9.5 HOLES C'SINK 82° X .875 DIA FAR SIDE TO MATCH V17-332001

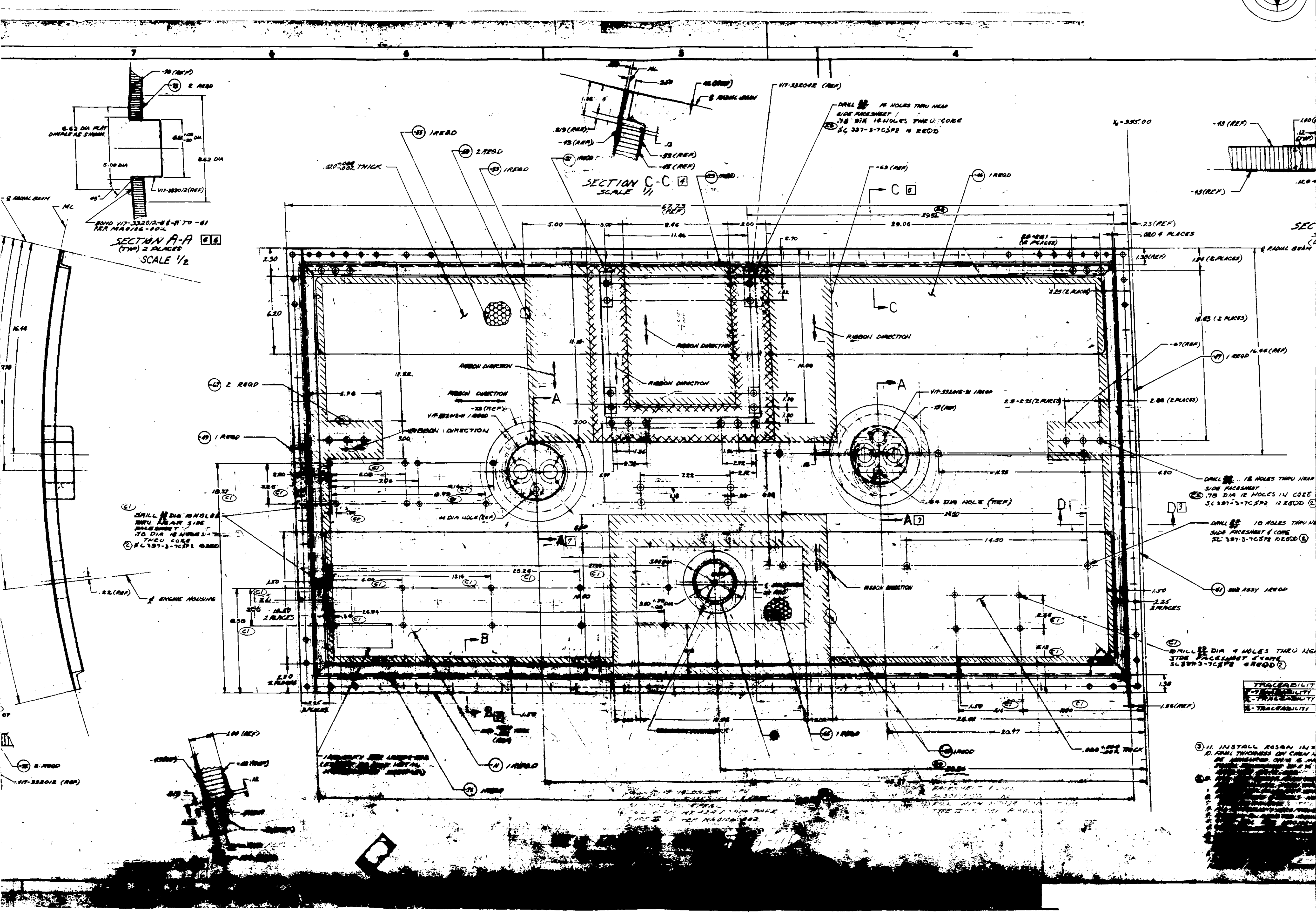
66.77
25.50
53.30
25.50
21.25
21.25
9.25
9.25
6.72
5.40
4.60
3.52
2.44
1.22
.23
.17
.18
.06 +.09 -.03
6.8
2.00
6.8
2.00
12.80
6.8
.050 THICK (STOCK)
.820 +.004 -.002 THICK
℄ RADIAL BEAM
2.62
2.00
4.00
6.00
8.00
3.90
200
400
600
800
K-46 (REF)
12.18 (REF)
.78 (REF)
.875 DIA (TYP)
V17-332012-21 (REF)
V17-332012-11 (REF)
.830 +.006 -.005 THICK
E
E
3.549 +.00 -.03
14.80
34.49
1.30
15.42
14.80
6.90
4.80
2.5 ±.250"
1.06
500 DIA
500 DIA MAX
4.96
4.80
4.60
2.41
.72
.53
2.00
2.18
4.60
4.12
4.92
℄ ENG HOUSING
2.62
2.62
22.94
22.68
81.56
34.32 (REF)
.820 +.006 -.005 THICK
.020 +.004 -.002 THICK
V17-332010 (REF)
.820 +.006 -.005 THICK
1 REQ'D
DRILL .78 DIA 8 HOLES EQUALLY SPACED THRU V17-332012-11 & -21, FACE SHEET & CORE. (2 PLACES) SL 397-3-7 SPF 16 REQD (2)
DRILL .78 DIA 80 HOLES THRU NEAR SIDE FACE SHEET & .78 DIA 80 HOLES THRU CORE SL 397-3-7 SPF 80 REQD

VIEW LOOKING INBD (E)
SCALE 1/2

.750
6.62 DIA (REF)
7.62 DIA
REF. DIA

SECTION E-E (5)
SCALE 1/2

2



SECTION A-A (TYP) 2 PLACES SCALE 1/2
6.62 DIA FLAT DIMPLE AS SHOWN
5.00 DIA
8.62 DIA
V17-332012(REF)
BOND V17-332012 TO -61 PER MA0106-002
℄ RADIAL BEAM
ML
SECTION C-C SCALE 1/1
V17-332042 (REF)
DRILL 14 HOLES THRU NEAR SIDE FACESHEET / .78 DIA 14 HOLES THRU CORE SL 337-3-7CSP2 14 REQD
.020 +.008 -.002 THICK
-55 1 REQD
-59 2 REQD
-53 1 REQD
-63 (REF)
-46 1 REQD
67.73 (REF)
5.00
3.00
8.46
11.46
2.00
29.52
29.06
.23 (REF)
.020 4 PLACES
1.30(REF)
1.84 (2 PLACES)
18.43 (2 PLACES)
16.44 (REF)
-67(REF)
-47 1 REQD
2.88 (2 PLACES)
RIBBON DIRECTION
-43 (REF)
-45 (REF)
2.30
6.20
12.58
3.00
14.00
11.46
V17-332012-11 1 REQD
-13 (REF)
.44 DIA HOLE (REF)
-67 2 REQD
-49 1 REQD
18.37
6.08
7.06
7.22
DRILL 12 HOLES THRU NEAR SIDE FACESHEET .78 DIA 12 HOLES IN CORE SL 397-3-7CSP2 12 REQD
DRILL 10 HOLES THRU NEAR SIDE FACESHEET & CORE SL 397-3-7CSP2 10 REQD
DRILL DIA 18 HOLES THRU NEAR SIDE FACESHEET .78 DIA 18 HOLES THRU CORE SL 397-3-7CSP2 18 REQD
℄ ENGINE HOUSING
.22 (REF)
14.50
11.95
4.80
12.50
20.24
13.14
6.08
26.94
14.50 2 PLACES
2.90 2 PLACES
3.00 DIA
3.50 +.30 -.00 DIA
-61 SUB ASSY 1 REQD
1.50
2.25 2 PLACES
DRILL DIA 4 HOLES THRU NEAR SIDE FACESHEET & CORE SL 397-3-7CSP2 4 REQD
1.38
1.36(REF)
26.88
20.97
.020 +.008 -.002 THICK
TRACEABILITY
1.00 (REF)
V17-332012 (REF)
11. INSTALL ROSAN IN
10. FINAL THICKNESS ON CHEM

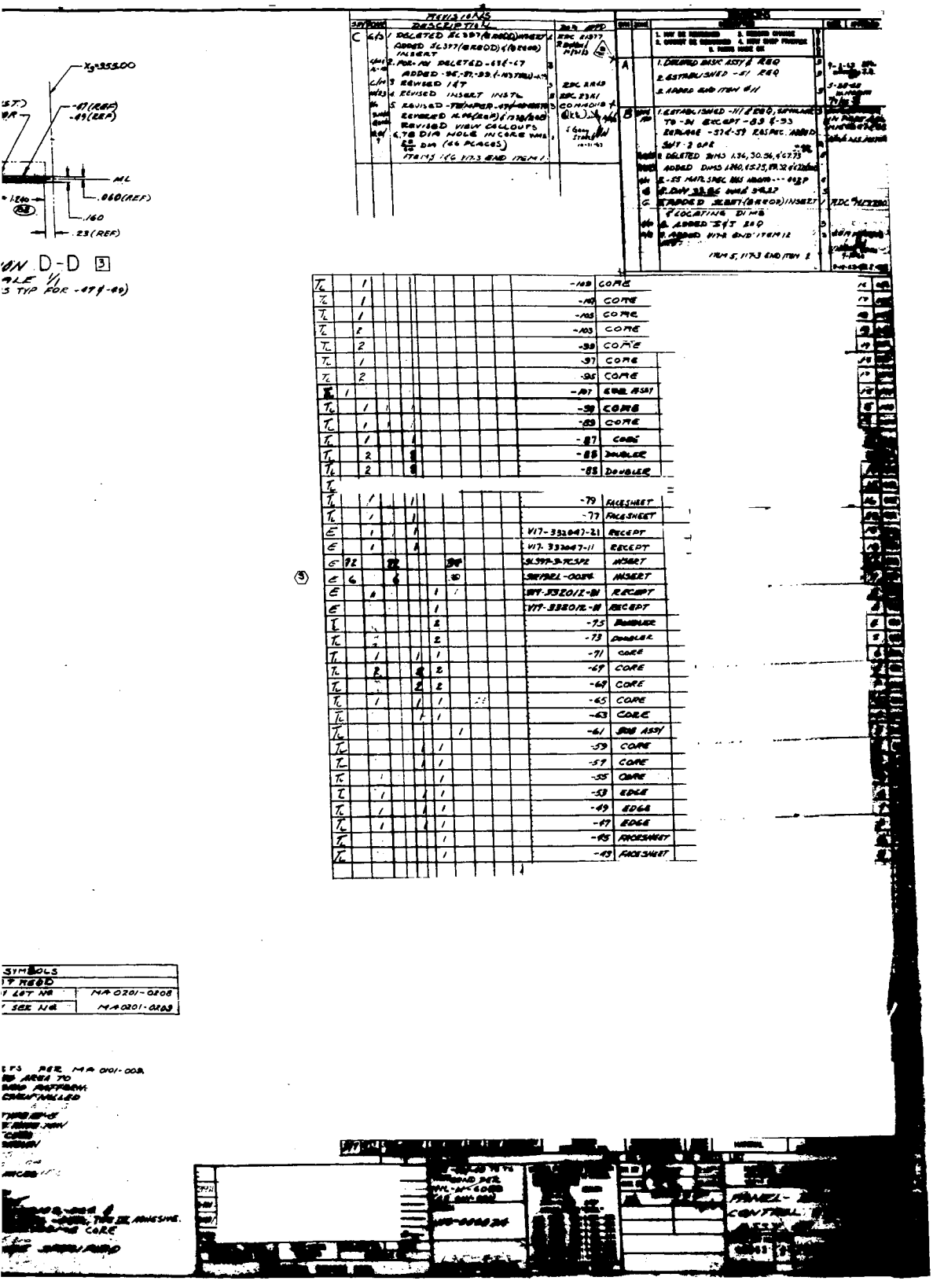
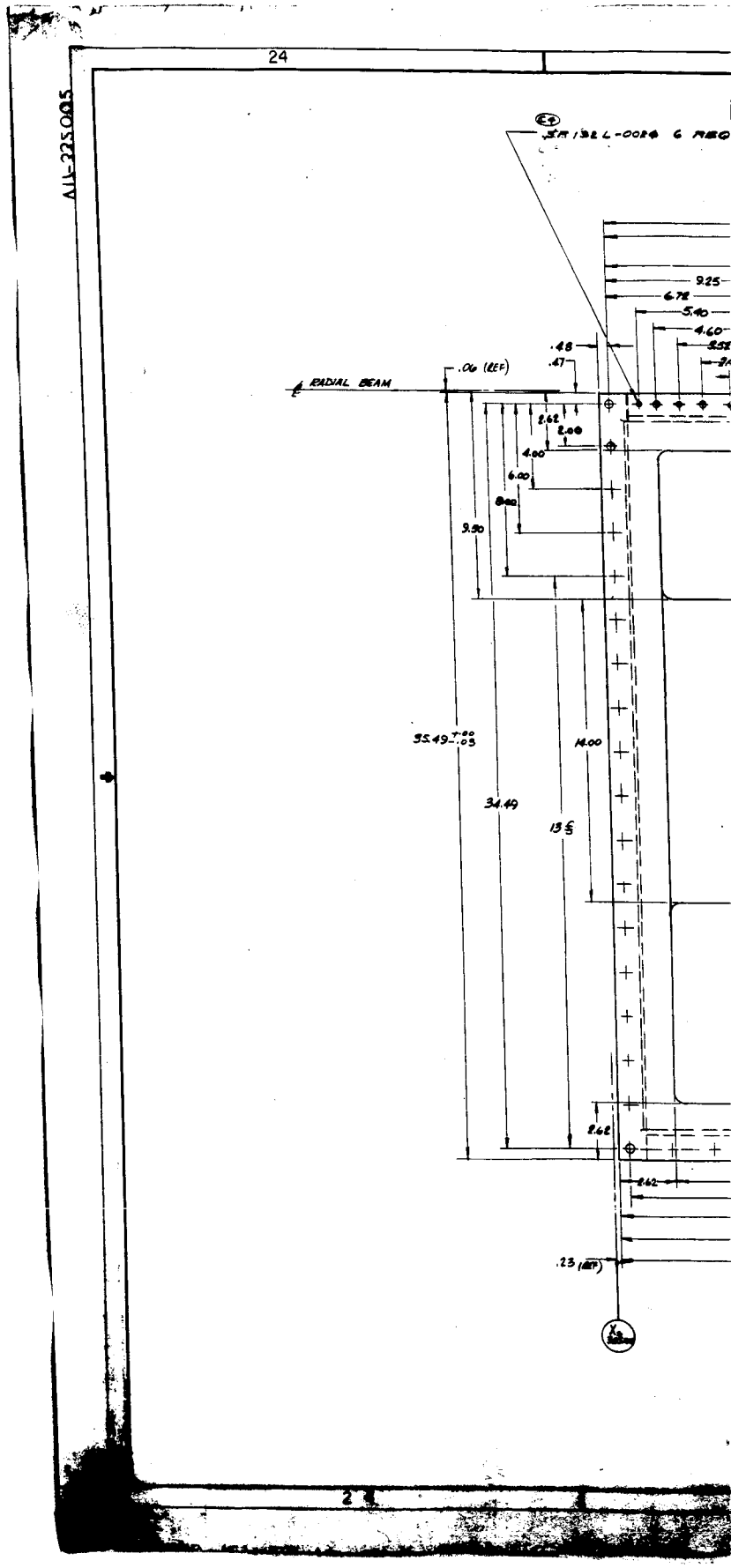


Figure 5-8. Panel Assembly, Reaction Control System (V17-332002-1)


24
AIL-225005
SEE 132L-0024 G FOR
9.25
6.78
5.40
4.60
.48
.47
.06 (REF)
℄ RADIAL BEAM
2.62
2.00
4.00
6.00
9.50
35.49 +.00 -.03
14.00
34.49
13 ℄
2.62
2.62
.23 (REF)
2

2

DRILL ⅜ DIA 6 HOLES TO MATCH V17-332001

DRILL ⅜ DIA 95 HOLES C'SK .82° X .484 +.005 -.000 DIA FAR SIDE TO MATCH V17-332001 & V17-332015

.050 THICK (STOCK)

.020 +.001 -.002 THICK

.080 +.001 -.002 THICK

-85 (REF)

-83 (REF)

V17-332047-21 (REF)

V17-332047-11 (REF)

7.25 DIA (TYP)

-75 (REF)

DRILL 13/32 DIA 80 HOLES THRU NEAR SIDE FACE SHEET & CORE SL 397-3-7CSP2 80 REQD (3) TO MATCH V17-332010

.020 +.001 -.002 THICK

V17-332010 (REF)

.080 THICK (STOCK)

-78 / REQD

VIEW LOOKING INBOARD (4) + (81)

ALL DIMENSIONS (BASIC) ON OUTSIDE SURFACE SHOWN

SCALE 1/2

DRILL 13/32 DIA 8 HOLES EQUALLY SPACED THRU V17-332047-11 & -21, FACE SHEET & CORE (2 PLACES) SL 397-3-7CSP2 16 REQD (2)

-85 2 REQD

V17-332047-21 (REF)

.650 DIA

.81 DIA FLAT DIMPLE AS SHOWN

10.00 DIA

BOND V17-332047-116-21 TO -81 PER MA0106-002

-83 (REF)

SECTION F-F (16)

TYPICAL 2 PLACES

SCALE 1/2

RECEPTACLE

.22 (REF)

℄ EMBRK HOUSING

12.75 DIA

9.00

8.16 DIA (REF)

.12

(28)

(43) 2 REQD

V17-332047-11 (REF)

9.12 +.10 -.05 (MAT'L-83)

SECTION G-G

SCALE 1/2

.100 (REF)

-77 (REF)

-79 (REF)

.219

.080 R

1.38

-11 (REF)

.050

(87) / REQD

.020 +.000 -.002 THICK

(82)

(88) / REQD

RIBBON DIR

(82)

(88) 2 REQD

(49) / REQD

(82)

(39) 2 REQD

RIBBON DIRECTION

RIBBON DIE

-85 (REF)

V17-332047-2

10.50 2 PLACES

2.00 2 PLACES

.250 2 PLACES

IDENTIFY PER LA0104-008 (EXCEPT DO NOT METAL IMPRESSION STAMP)

(71) / REQD

(-H) / REQD

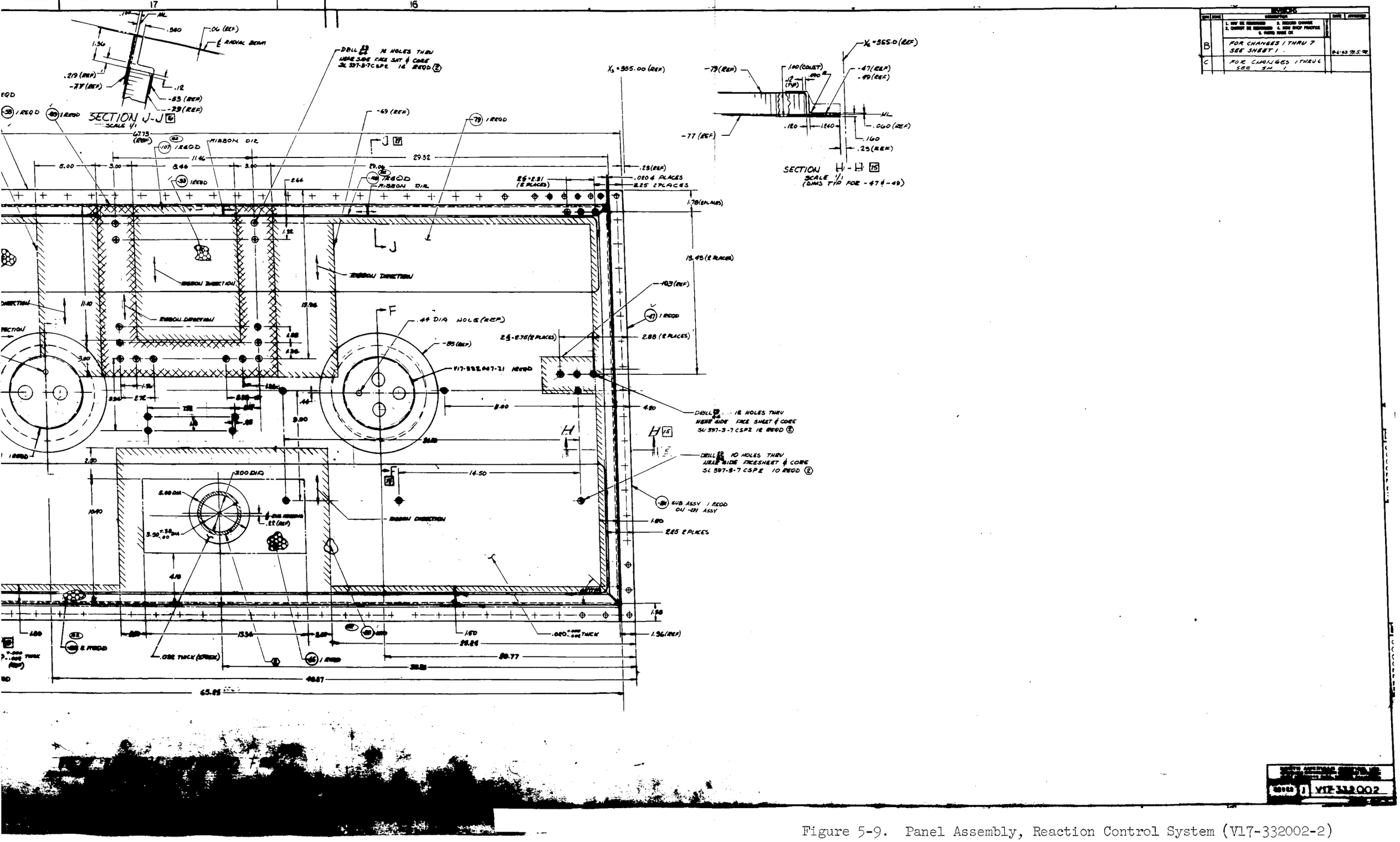
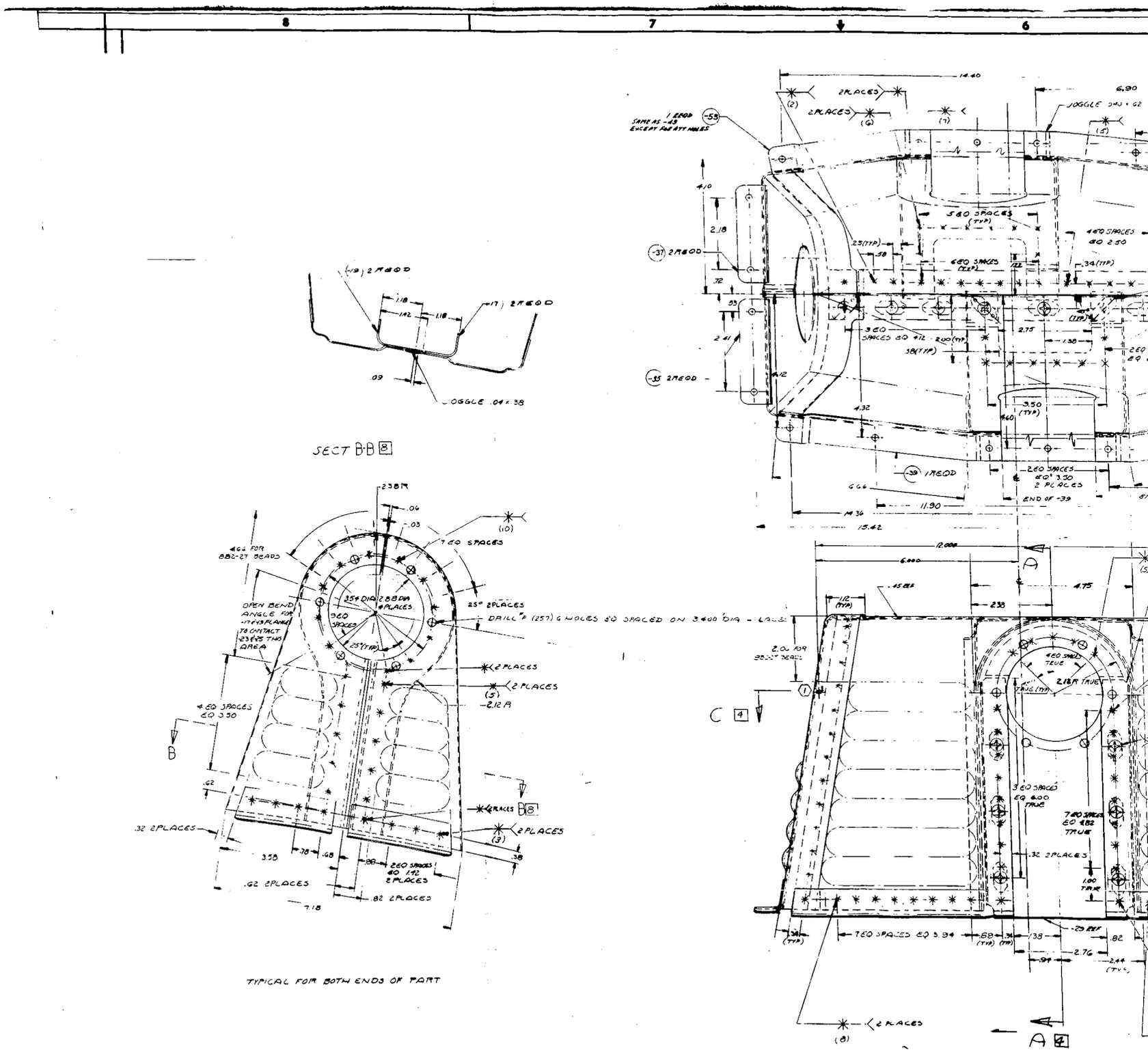


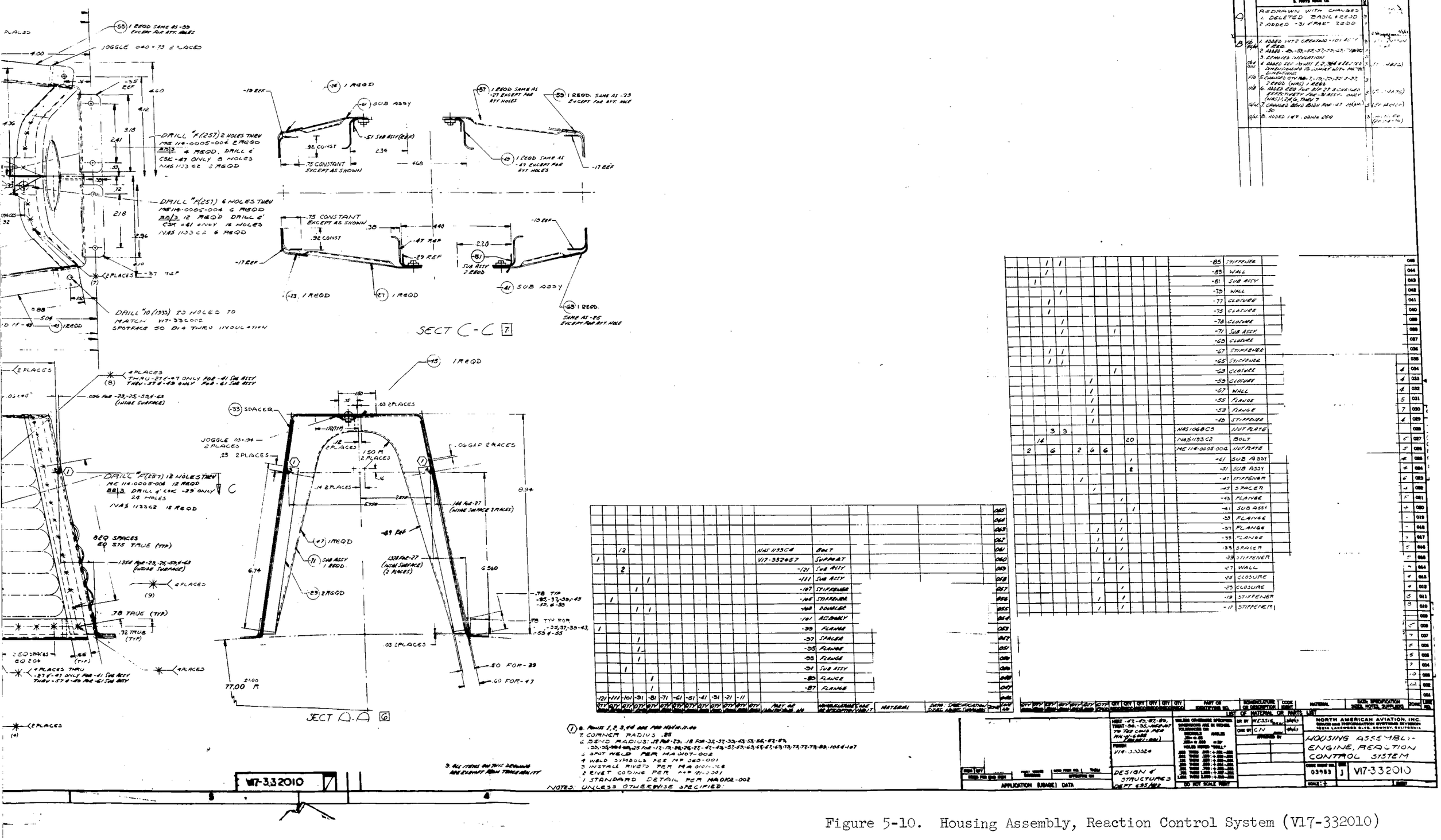
Figure 5-9. Panel Assembly, Reaction Control System (V17-332002-2)


8
7
6
14.40
6.90
2 PLACES
(2)
2 PLACES
(6)
(7)
JOGGLE .040 x 62
(-55)
SAME AS -43 EXCEPT FOR ATT HOLES
1 REQD
4.10
2.18
(-37) 2 REQD
580 SPACES (TYP)
460 SPACES EQ 2.50
.23(TYP)
.58
680 SPACES (TYP)
.34(TYP)
.72
.33
2.41
360 SPACES EQ .472
.38(TYP)
2.75
1.38
(-35) 2 REQD
.42
4.32
350 (TYP)
.60
(-39) 1 REQD
260 SPACES EQ 1.350 2 PLACES
END OF -39
6.66
11.90
M36
15.42
12.000
6.000
A
.45 REF
4.75
.238
.12 (TYP)
2.04 FOR ABSENT BEAD
460 SPACES TRUE
2.18R TRUE
(1)
C 4
360 SPACES EQ 1.00 TRUE
780 SPACES EQ .482 TRUE
.32 2 PLACES
1.00 TRUE
.20 REF
.82
2.76
2.44 (TYP)
760 SPACES EQ 3.94
.88 (TYP)
.38
.97
.34 (TYP)
(8) 2 PLACES
A 4
(1/2) 2 REQD
1.18
1.42
1.18
(17) 2 REQD
.09
JOGGLE .04 x 38
SECT B-B 8
2.38R
.04
.03
(10)
760 SPACES
464 FOR BB2-27 BEAD
.354 DIA
.288 DIA
8 PLACES
960 SPACES
25° 2 PLACES
DRILL "F" (257) 6 HOLES EQ SPACED ON 3.400 DIA - LALSE
OPEN BEND ANGLE FOR .119 FLANGE TO CONTACT 23 EQS THIS AREA
25° (TYP)
2 PLACES
(5)
2.12 R
460 SPACES EQ 3.30
B
.62
.32 2 PLACES
.358
.78
.68
.88
260 SPACES EQ 1.42 2 PLACES
.82 2 PLACES
.38
.62 2 PLACES
7.18
2 PLACES B 8
2 PLACES
(3)
TYPICAL FOR BOTH ENDS OF PART
-31 ASSY

2

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION

Volume: DIM-9
Section: 5
Page: 12
Date: 2-19-64
Rev. Date:



ITEM	ZONE	REVISIONS DESCRIPTION	DATE	APPROVED
		1. MAY BE RESTORED 3. RECORD CHANGE 5. CANNOT BE RESTORED 4. NON SHOP PRACTICE 6. PARTS WORK OK		
		REDRAWN WITH CHANGES 1. DELETED BASIC # REQD 2. ADDED -31 PART REQD		
B		A. ADDED .147 2 DRILLING -101 ASSY 1 REQD. B. ADDED -19, -53, -55, -57, -59, -63, -79 & -83 C. REMOVED INSULATION D. ADDED REF DIM WITH 2.394 & 2.22 (.93 DIMENSIONING TO AGREE WITH ME 114-0005 DRAWING E. CHANGED QTY REQD -7, -19, -53, -55 & -57 2 REQD (WAS) 1 REQD F. ADDED CRD TOL FOR 27 & .1378 (WAS REFERENCE) FOR -31 ASSY. ONLY (WAS) 1, 2 & 6, THRU 7 G. CHANGED BEND RADII FOR -27 (WAS) -50 H. ADDED 1 QT. DWG REQ		

QTY	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT	MATERIAL	DATA SPECIFICATION SIZES, NOTES, SUPPLIERS	ITEM NO.
-85		STIFFNER				
-83		WALL				
-81		SUB ASSY				
-75		WALL				
-77		CLOSURE				
-75		CLOSURE				
-78		CLOSURE				
-71		SUB ASSY				
-69		CLOSURE				
-67		STIFFENER				
-65		STIFFENER				
-63		CLOSURE				
-59		CLOSURE				
-57		WALL				
-55		FLANGE				
-53		FLANGE				
-49		STIFFENER				
8	NAS1068C3	NUT PLATE				
20	NAS1133C2	BOLT				
14	ME114-0005-004	NUT PLATE				
2	-61	SUB ASSY				
6	-31	SUB ASSY				
2	-47	STIFFENER				
6	-45	SPACER				
6	-43	FLANGE				
2	-41	SUB ASSY				
	-39	FLANGE				
	-37	FLANGE				
	-35	FLANGE				
	-33	SPACER				
	-29	STIFFENER				
	-27	WALL				
	-25	CLOSURE				
	-23	CLOSURE				
	-19	STIFFENER				
	-17	STIFFENER				

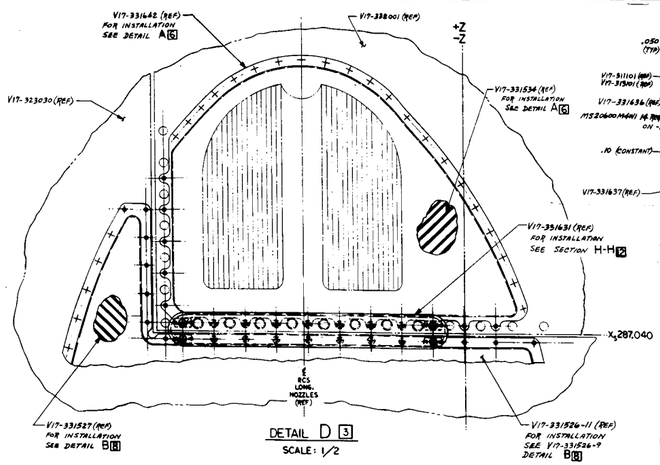
QTY	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT	MATERIAL	DATA SPECIFICATION SIZES, NOTES, SUPPLIERS	ITEM NO.
1/2	NAS1133C4	BOLT				
1	V17-332057	SUPPORT				
2	-121	SUB ASSY				
1	-111	SUB ASSY				
1	-107	STIFFENER				
1	-105	STIFFENER				
1	-103	DOUBLER				
1	-101	ACCESORY				
1	-39	FLANGE				
1	-37	SPACER				
1	-35	FLANGE				
1	-33	FLANGE				
1	-31	SUB ASSY				
1	-89	FLANGE				
1	-87	FLANGE				

(1) 6. PRIME 1, 2, 3, 4 & 5 PER MA 10-10-40
7. CORNER RADIUS .25
8. BEND RADIUS .38 FOR -23, .18 FOR -35, -37, -39, -43, -53, -55, -83, -87, -35, -39, -43, -53, -55 FOR -12, -13, -21, -22, -47, -49, -57, -63, -65, -67, -69, -73, -75, -77, -79, -89, -105 & -107
9. SPOT WELD PER MA W07-002
10. WELD SYMBOLS PER MP 360-001
11. INSTALL RIVETS PER MA 0101-108
12. RIVET CODING PER MP 21-2391
13. STANDARD DETAIL PER MA0102-002

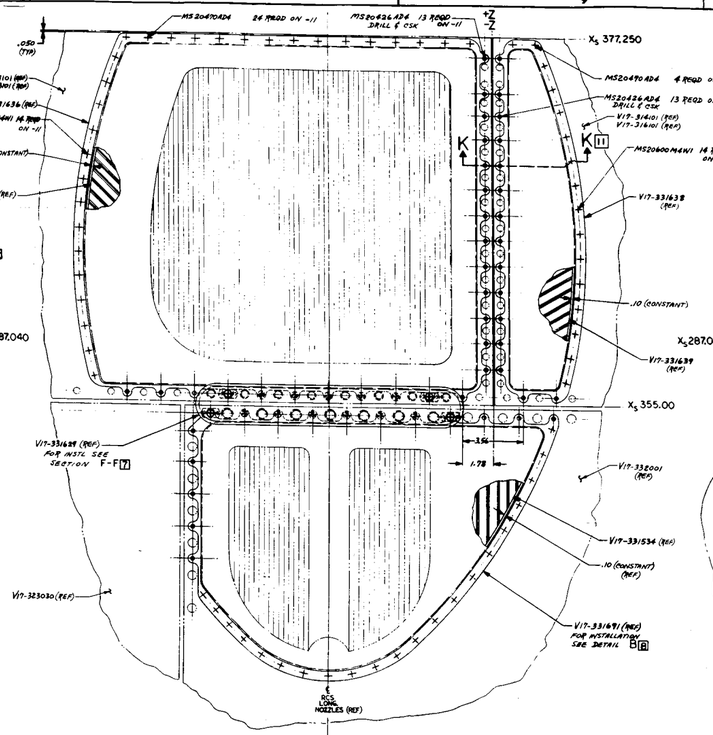
NOTES: UNLESS OTHERWISE SPECIFIED

MAT'L -43, -45, -47, -49, -53, -55, -63, -69, -71 TO .125 COLD ROLL MIL-H-6088 (ANEALED CONDITION)	DESIGN & STRUCTURES DEPT 695-162	DR BY WESSIE 6/6/63	NORTH AMERICAN AVIATION, INC.
FINISH V17-330024		CHK BY C.N. 6/6/63	HOUSING ASSEMBLY-ENGINE, REACTION CONTROL SYSTEM
APPLICATION (USAGE) DATA		APPROVED BY	CODE IDENT 03983 SIZE J DWG NO. V17-332010
		DO NOT SCALE PRINT	SCALE: 1

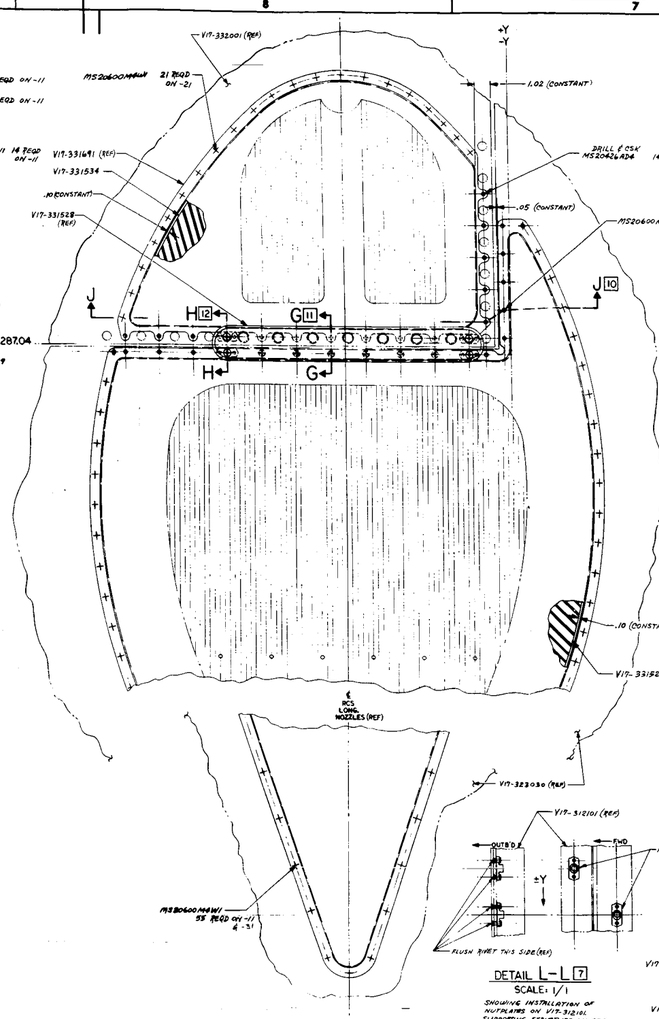
Figure 5-10. Housing Assembly, Reaction Control System (V17-332010)



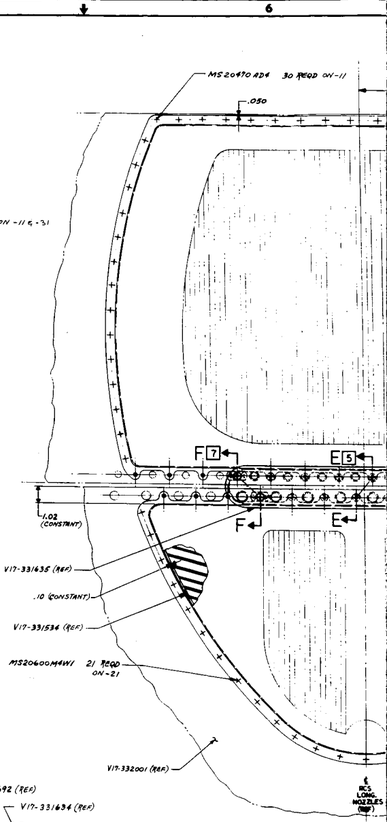
DETAIL D 3
SCALE: 1/2

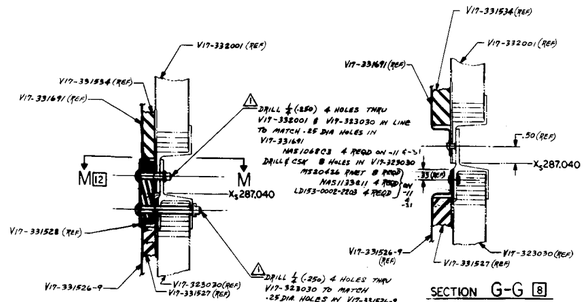


DETAIL C 3
SCALE: 1/2



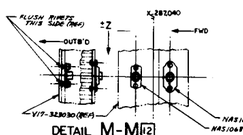
DETAIL B 3
SCALE: 1/2



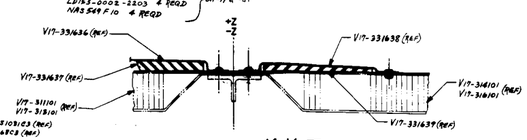


SECTION H-H 8 -4 PLACES
SCALE: 1/1
(TYP FOR V17-331631 INSTL)

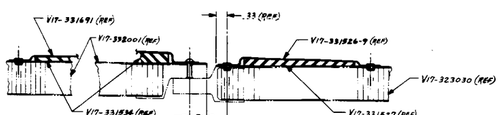
SECTION G-G 8
SCALE: 1/1



DETAIL M-M 12
SCALE: 1/1
SHOWING INSTALLATION OF NUTPLATES ON V17-323030. SUPPORTING STRUCTURE OMITTED FOR CLARITY.

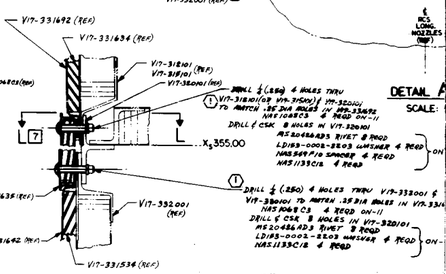


SECTION K-K 9
SCALE: 1/1



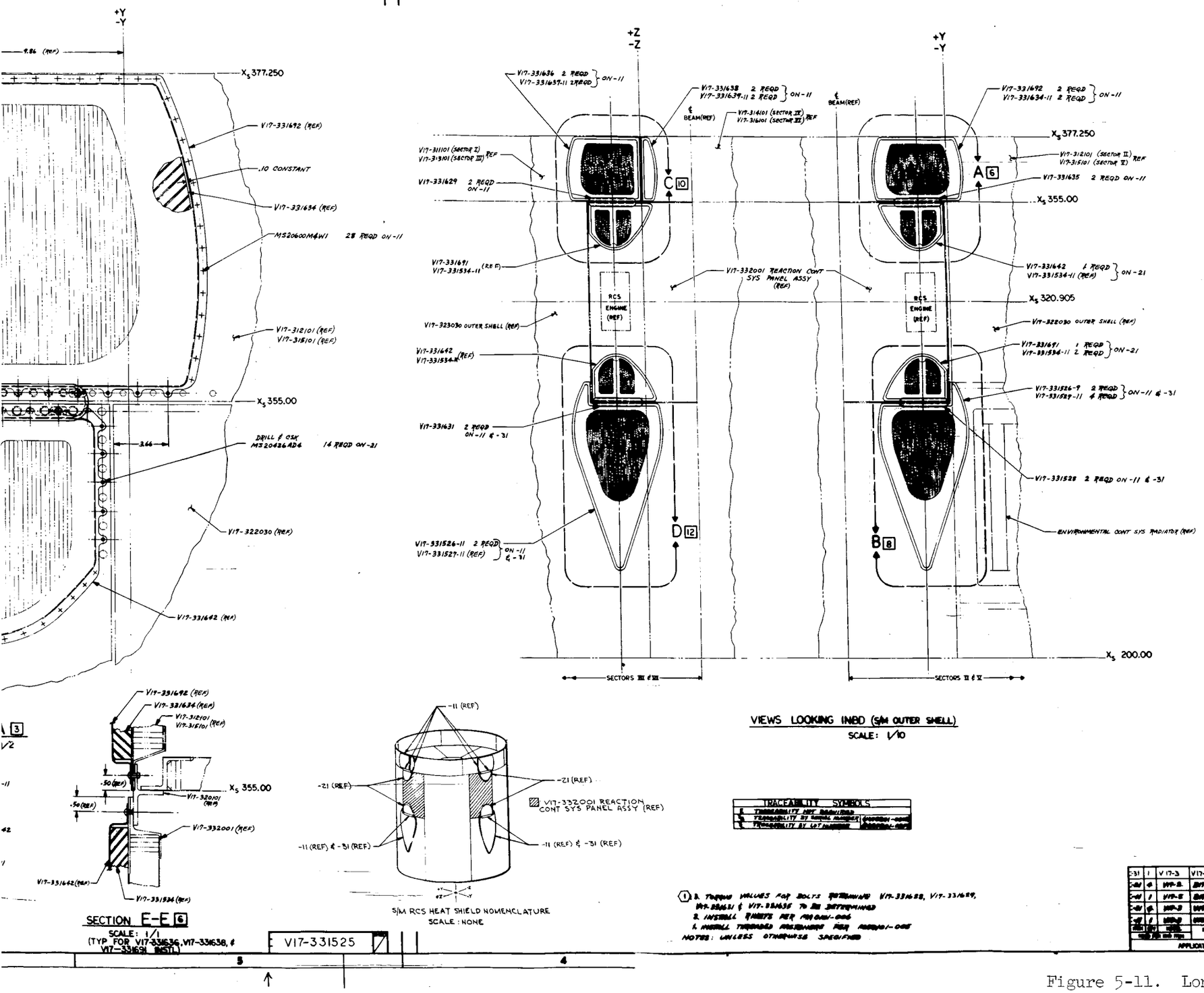
SECTION J-J 7
SCALE: 1/1

DETAIL L-L 7
SCALE: 1/1
SHOWING INSTALLATION OF NUTPLATES ON V17-312101. SUPPORTING STRUCTURE OMITTED FOR CLARITY.



SECTION F-F 6 -4 PLACES
SCALE: 1/1
(TYP FOR V17-331629 INSTL)

V17-331525



SECTION E-E 6
SCALE: 1/1
(TYP FOR V17-331636, V17-331638, & V17-331631 INSTL)

S/M RCS HEAT SHIELD NOMENCLATURE
SCALE: NONE

VIEWS LOOKING INBD (S/M OUTER SHELL)
SCALE: 1/10

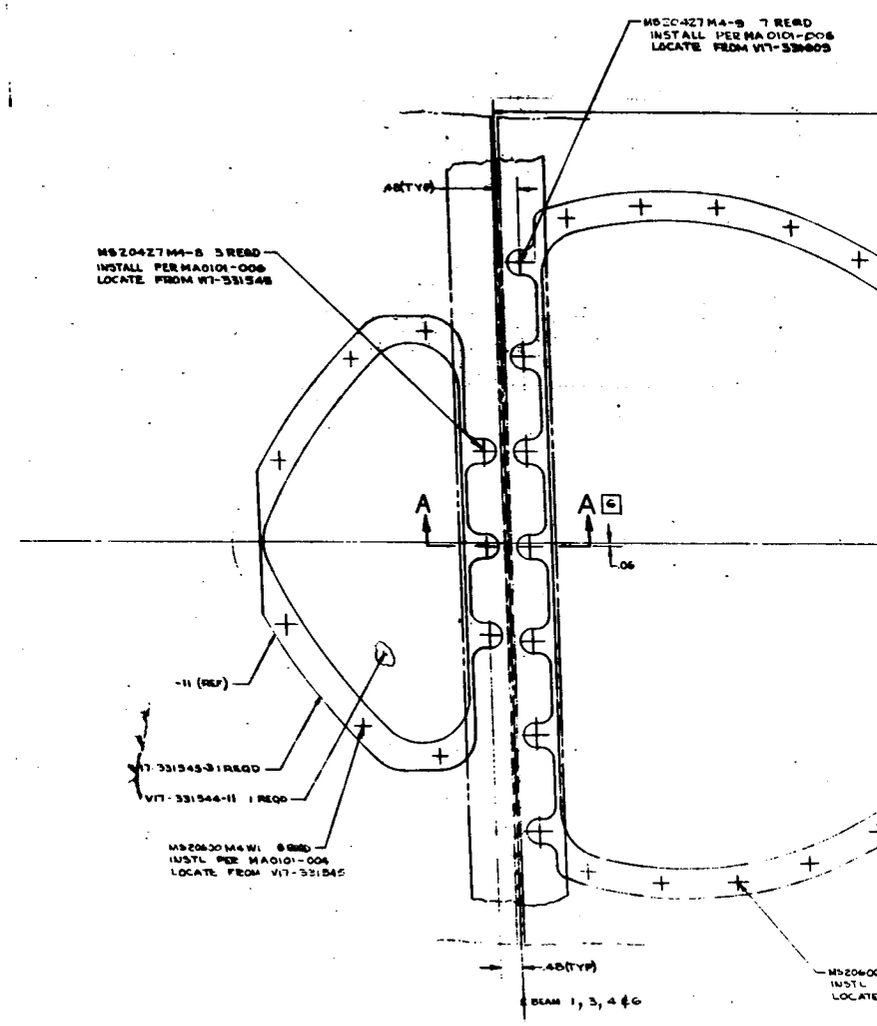
TRACEABILITY SYMBOLS

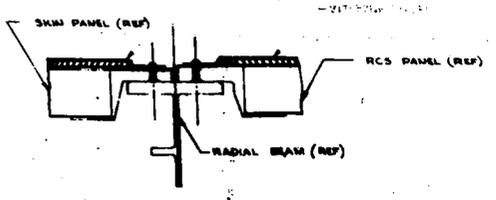
NOTES: UNLESS OTHERWISE SPECIFIED

V17-331525

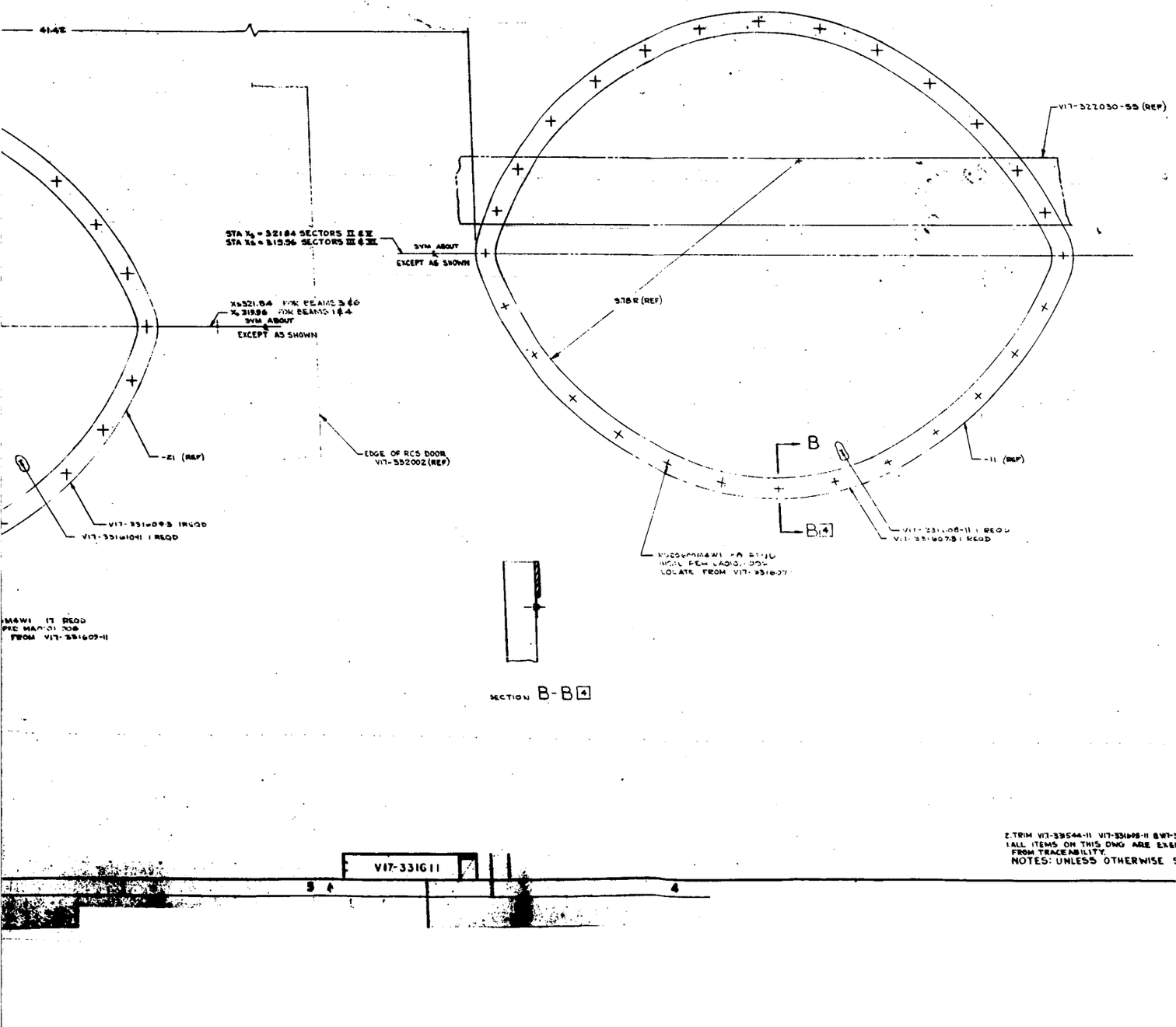
Figure 5-11. Longitudinal Heat Shield Installation, Reaction Control System (V17-331525)

A15-221611





SECTION A-A



ITEM	QTY	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT.	MATERIAL	DATA SPECIFICATION SIZES, NOTES, SUPPLIERS	ZONE	LINE NO.
-11	4	MS20600M4W1	RIVET					
-21	4	V17-331630-11	SEALER					
-11	1	V17-331613-11	INSULATION					
-3	1	V17-331610-3	COVER					
-11	1	V17-331608-11	INSULATION					
-3	1	V17-331609-3	COVER					
-11	1	V17-331611	HEAT SHIELD INSTL					
-3	1	V17-331545-3	COVER					
-11	1	V17-331544-11	INSULATION					
-11	1	V17-331611	HEAT SHIELD INSTL					

LIST OF MATERIAL OR PARTS LIST

-11	4	V17-2			6812	-		
-21	4	V17-2	V17		6812	-		
-22	4	V17-3	V17-3			-		
-11	4	V17-3	V17-3			-		

(PAGE) DATA

HEAT TREAT		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON: DECIMALS .XX ± .03, .XXX ± .010, ANGLES 30' ± 30' HOLES NOTED "DRILL"	DR BY
FINISH			CHK BY
DESIGN & STRUCTS 693-622 EXT 30134		DO NOT SCALE PRINT	APPROVED BY

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

HEAT SHIELD INSTL-
REACTION CONT SYS,
MOTOR EXHAUST, LATERAL

CODE IDENT NO	SIZE	
03953	J	V17-331611

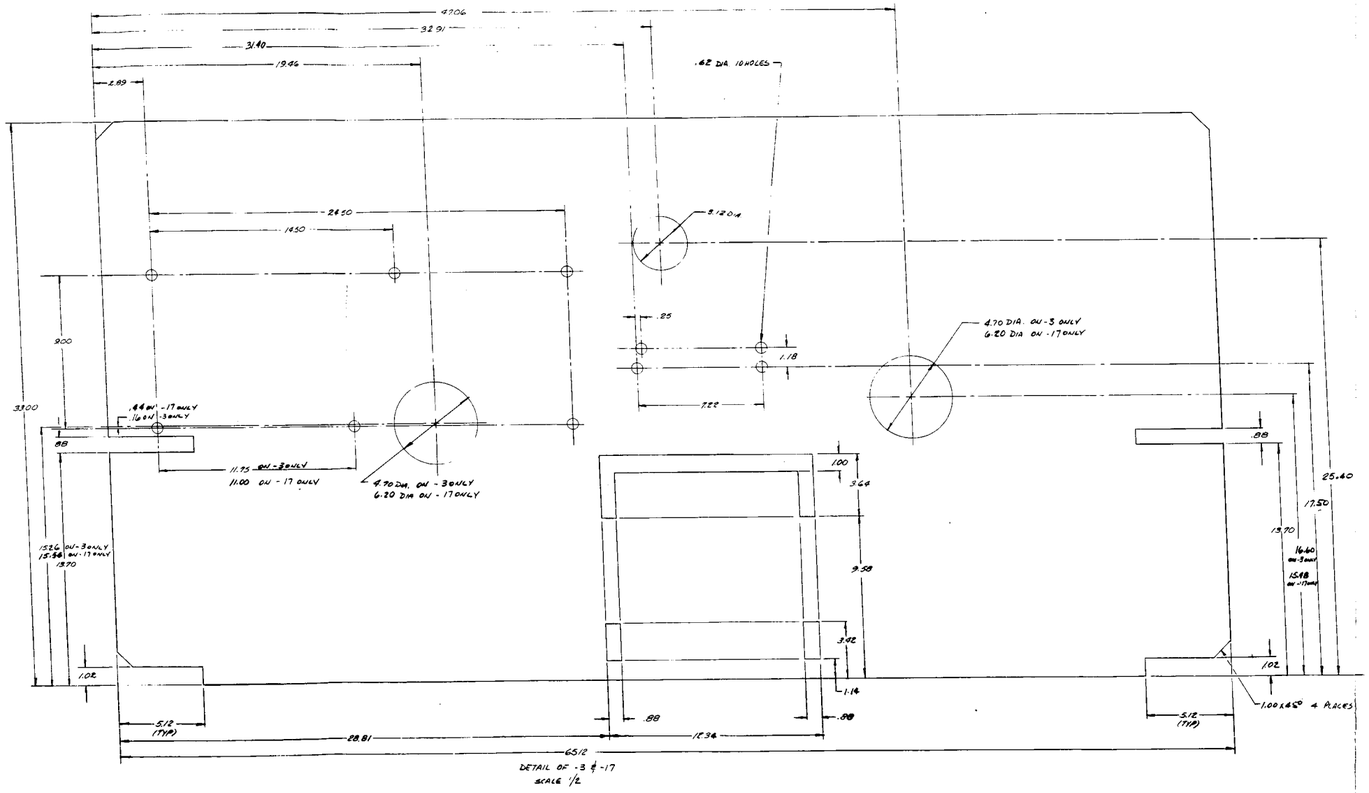
SCALE 1/1 SHEET

REVISIONS

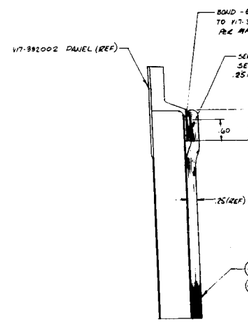
SYM	ZONE	DESCRIPTION	DATE	APPROVED
A		1. MAY BE REWORKED 2. RECORD CHANGE 3. CANNOT BE REWORKED 4. NOW SHOP PRACTICE 5. PARTS MADE OR 1. REMOVED RIVET LOCATING DIMS 2. MS20600M4W1 (BMS) WAS 1738M4-1 3. V17-331609 (WAS) V17-331607 4. V17-331610 (WAS) V17-331608 5. ITEM 6 L/M -11 & -21 TO AGREE 6. IN L/M -11 & -21 (WAS) -11 & -2 & CHANGED APPLIC. TO AGREE ITEM #344, V17-3 #1,2,4,6,7&8 V17-2 #6		
B		1. ADDED V17-2 #12 2. ADDED IN ASSY. AS STOCK -11 & -21 REQ'D V17-2, BIT-000002, END ITEM 6 EFFECT ON V17-2 #6&12 V17-3 #1,2,4,6,7,8		
C	KN LAA & PD	1. ADDED NOTES 1 & 2 2. V17-331544-11 WAS V17-331544 3. V17-331545-3 WAS V17-331545 4. V17-331607-3 WAS V17-331607 5. V17-331608-11 WAS V17-331608 6. V17-331609-3 WAS V17-331609 7. V17-331610-11 WAS V17-331610 8. IN -11 INSTL MS20600M4W1 54 REQD WAS 55 REQD EFFECT ON V17-2 END ITEM #6 &12 V17-3 END ITEM #1, 2, 4, 6, 7 & 8	11-1-64	RN GUGLEY

2. TRIM V17-331544-11 V17-331608-11 & V17-331610-11 ON INSTL.
1. ALL ITEMS ON THIS DWG ARE EXEMPT FROM TRACEABILITY.
NOTES: UNLESS OTHERWISE SPECIFIED

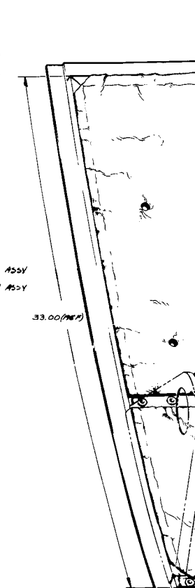
Figure 5-12. Lateral Heat Shield Installation, Reaction Control System (V17-331611)



DETAIL OF -3 & -17
SCALE 1/2



SECTION A-A
SCALE 1/1



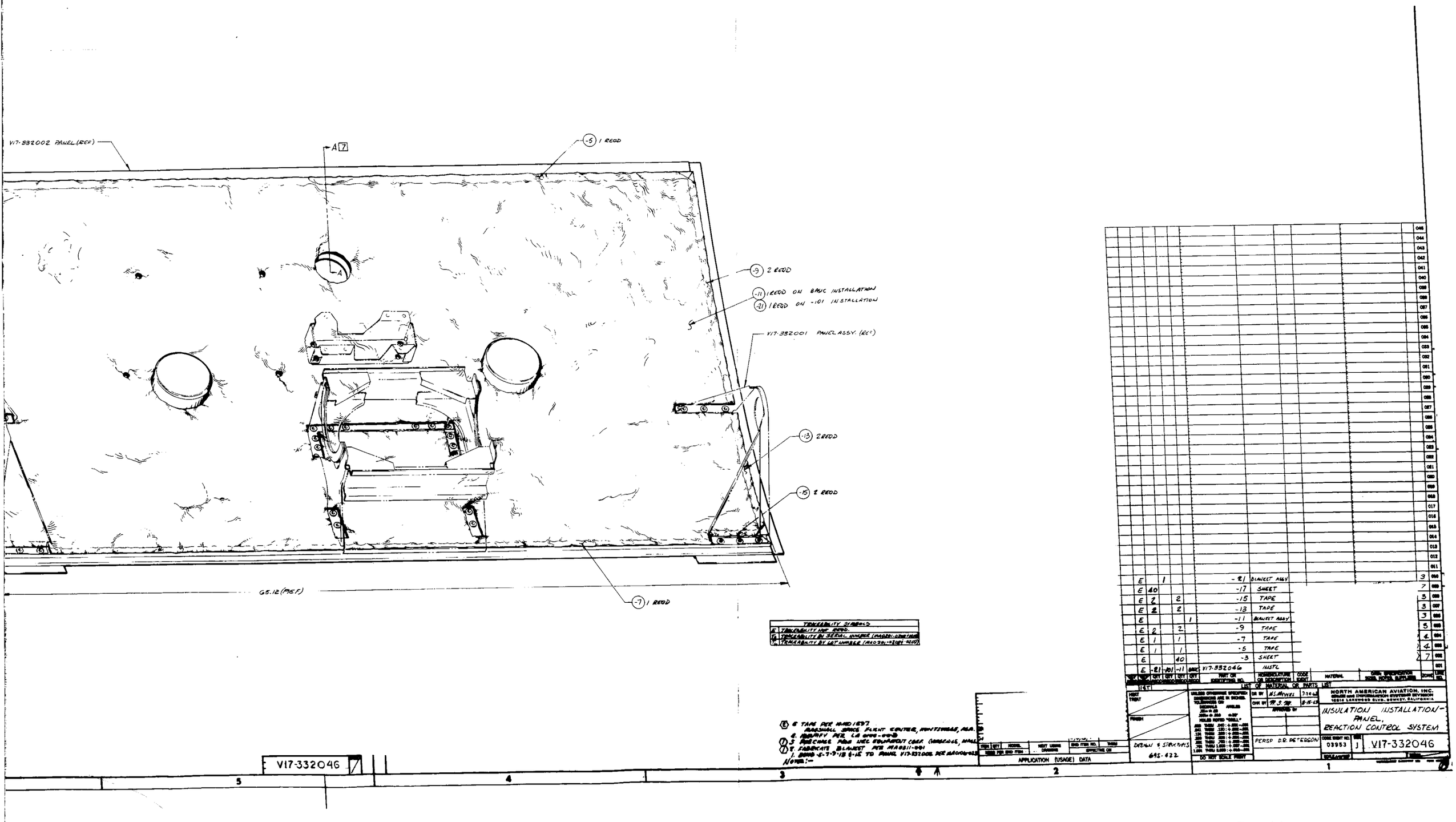
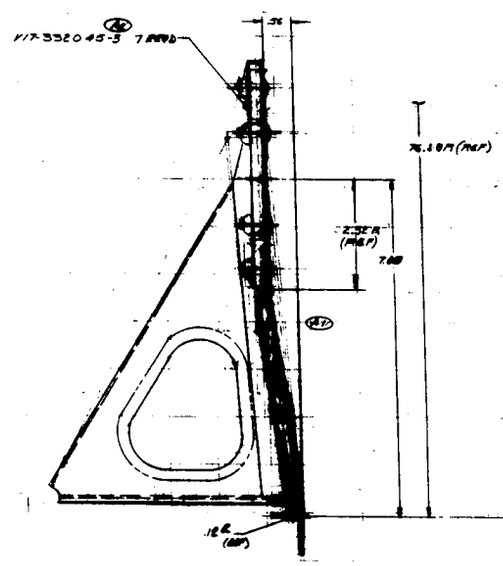
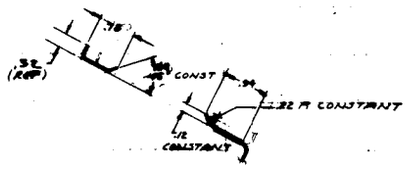


Figure 5-13. Insulation Installation for Reaction Control System (V17-332046)



SECTION A-A



SECTION B-B

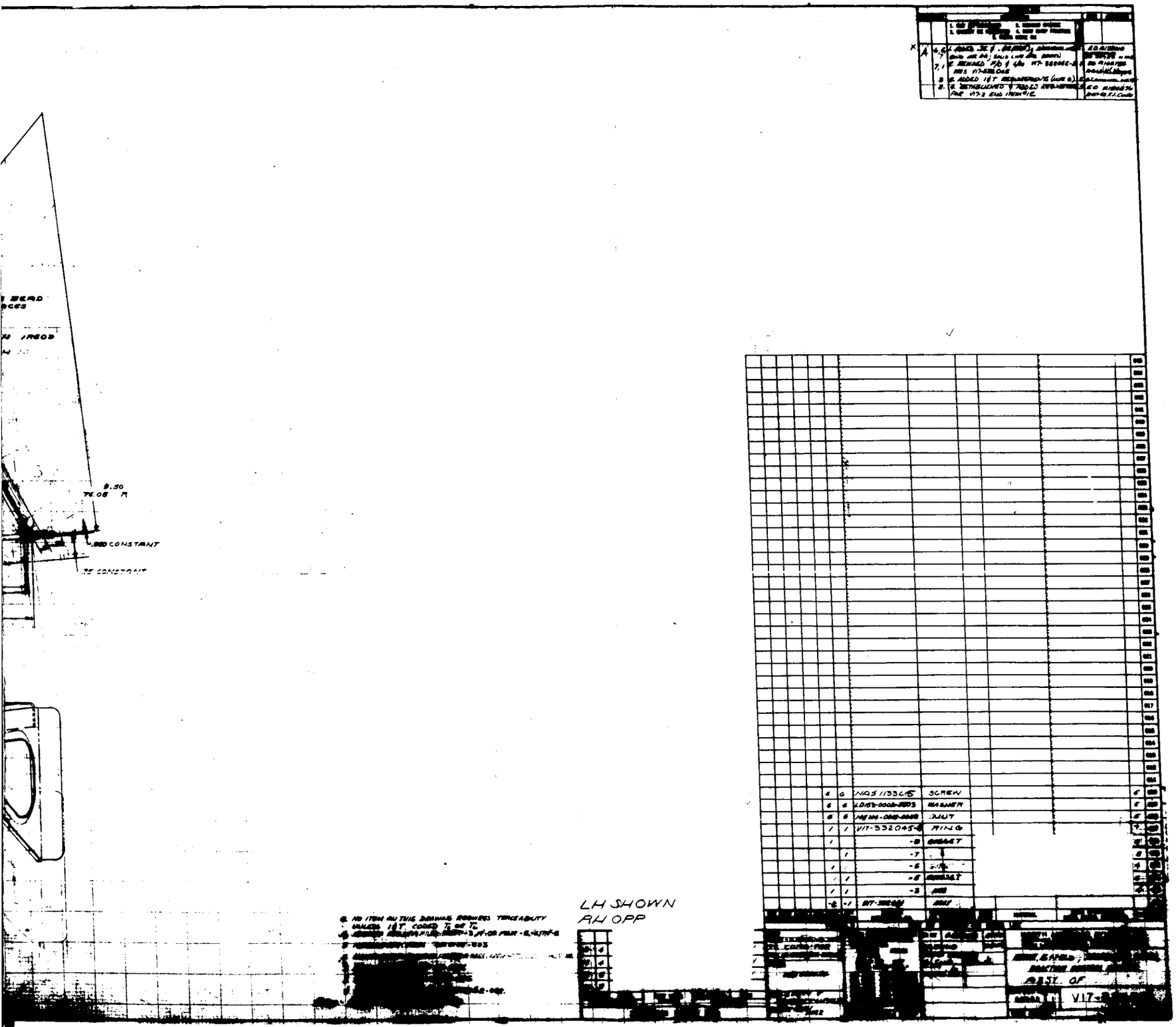
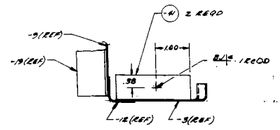
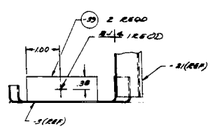


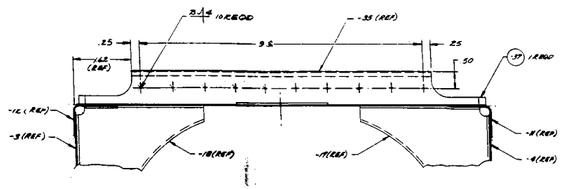
Figure 5-14. End Mounting Assembly of Propellant Tanks, Reaction Control Sy tem (V17-332041)

AIL-325045

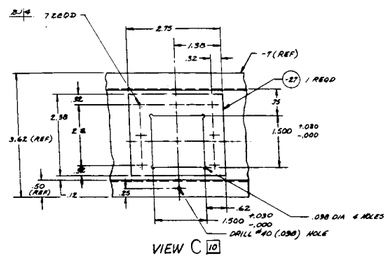


SECTION J-J [6]

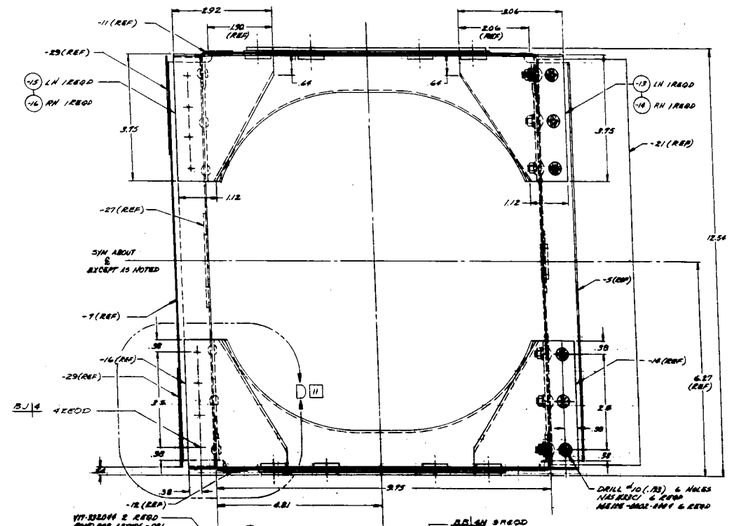


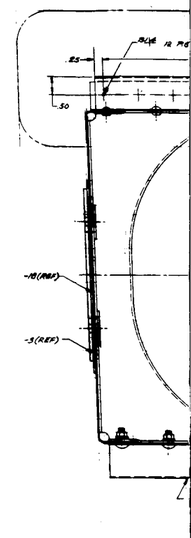


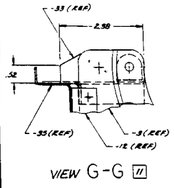
VIEW E-E [9]
FOR -21 ASSY ONLY



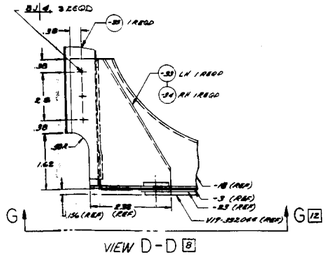
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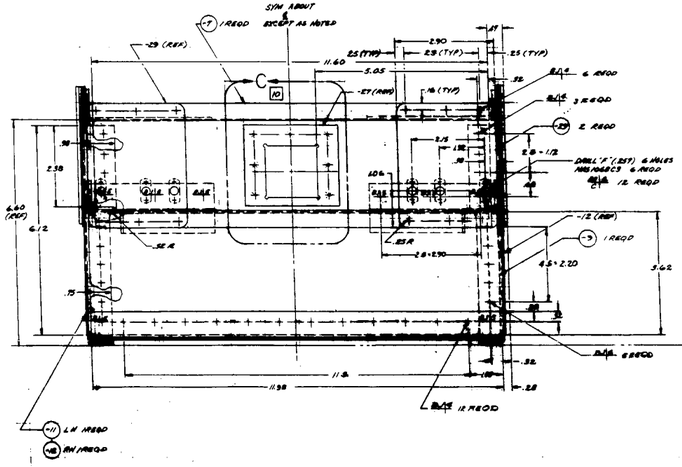


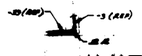


VIEW G-G [11]



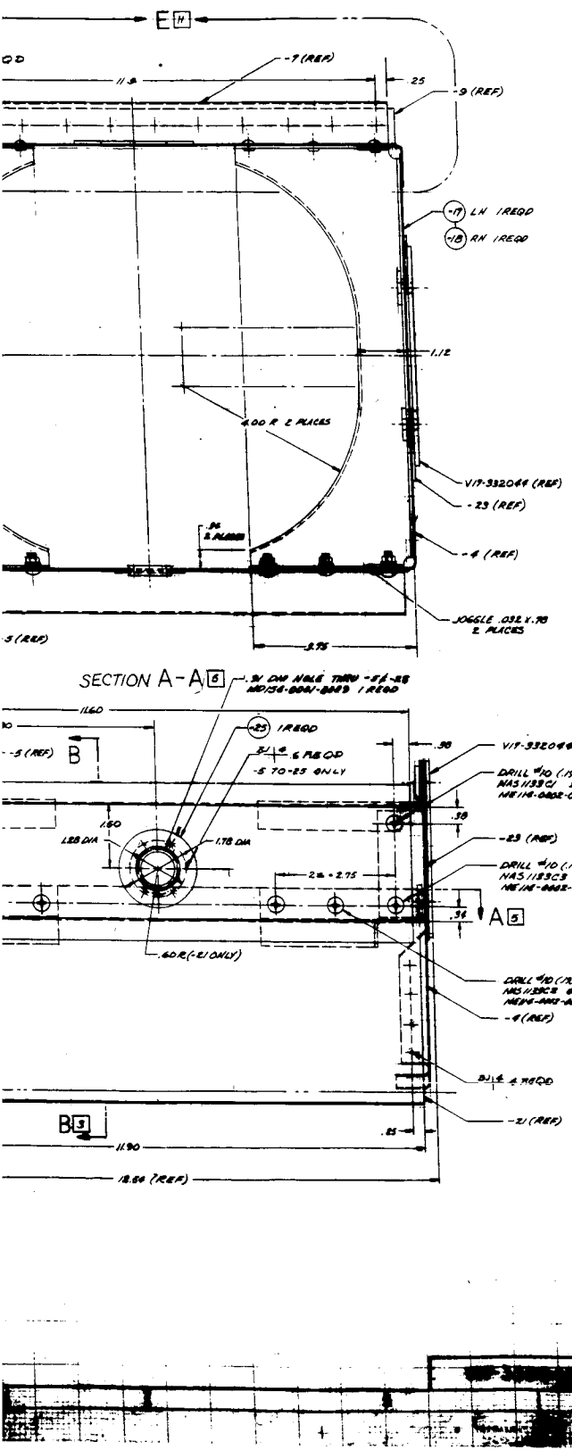
VIEW D-D [8]
TYP BOTH SIDES
(FOR -21 ASSY ONLY)





SECTION H-H [7]
(TYP -33 & -37)

VIT-332042



REVISIONS						
SYS	ZONE	DESCRIPTION			DATE	APPROVED
		1. NOT BE REWORKED 2. RECORD CHANGE 3. CANNOT BE REWORKED 4. HIGH SPOT PRACTICE 5. PARTS MADE OR				
A	X	1. PREPLACED SPOT WELDS WITH RIVET	1		80164K	
		2. ADDED REQ FOR MP2 EQUIT&MR	2		80164K	SUPERSEDE
		DELETED REQ FOR MP3 AND ITEM11				IN PART
		3. ADDED JET ECO	3		80164K	

2	2	NAS1133C3	BOLT	5	084
4	4	NAS1133C2	BOLT	5	083
8	8	NAS6336C1	BOLT	5/9	082
	6	AMS10685C3	NUT	9	081
16	16	MS21142-M12-0044	NUT	5/9	080
1	1	MD5K-0001-0109	GROMMET	5	079
2	2	VI7-332044	COLLAR	8	078
8	8	VI7-331030	SPACER	5	077
2	2	-41	DOUBLER	1	076
2	2	-39	DOUBLER	4	075
1		-37	WEB	10	074
1		-35	CHANNEL	11	073
1		-34	GUSSET RH	4	072
1		-33	GUSSET LH	4	071
	2	-29	PLATE	4	070
1	1	-27	DOUBLER	7	069
1	1	-25	DOUBLER	5	068
2	2	-23	DOUBLER	8	067
1	1	-21	WEB	7	066
1	1	-19	ANGLE	8	065
1	1	-18	BULKHEAD RH	5	064
1	1	-17	BULKHEAD LH	5	063
1	1	-16	GUSSET RH	8	062
1	1	-15	GUSSET LH	8	061
	1	-14	GUSSET RH	7	060
	1	-13	GUSSET LH	7	059
1	1	-12	ANGLE RH	10	058
1	1	-11	ANGLE LH	14	057
	1	-9	WEB	7	056
	1	-7	CHANNEL	10	055
1	1	-5	CHANNEL	7	054
1	1	-4	WEB RH	7	053
1	1	-3	WEB LH	7	052
-51		VI7-332042	ASSY		051

QTY	QTY	QTY	QTY	ITEM	PART NO.	MATERIAL

DRAWN	[illegible]	6-7-63
CHECKED	R.S.D.	6-20-63
STRESS		
P.A. Cond.		

NORTH AMERICAN AVIATION, INC.
10916 LANEWOOD BLVD., DOWNEY, CALIFORNIA

MOUNT ASSY - PROPELLANT & PRESSURE TANKS, REACTION CONTROL SYSTEM

CODE IDENT NO.	SIZE	DRAWING NO.
03883	J	VI7-332042

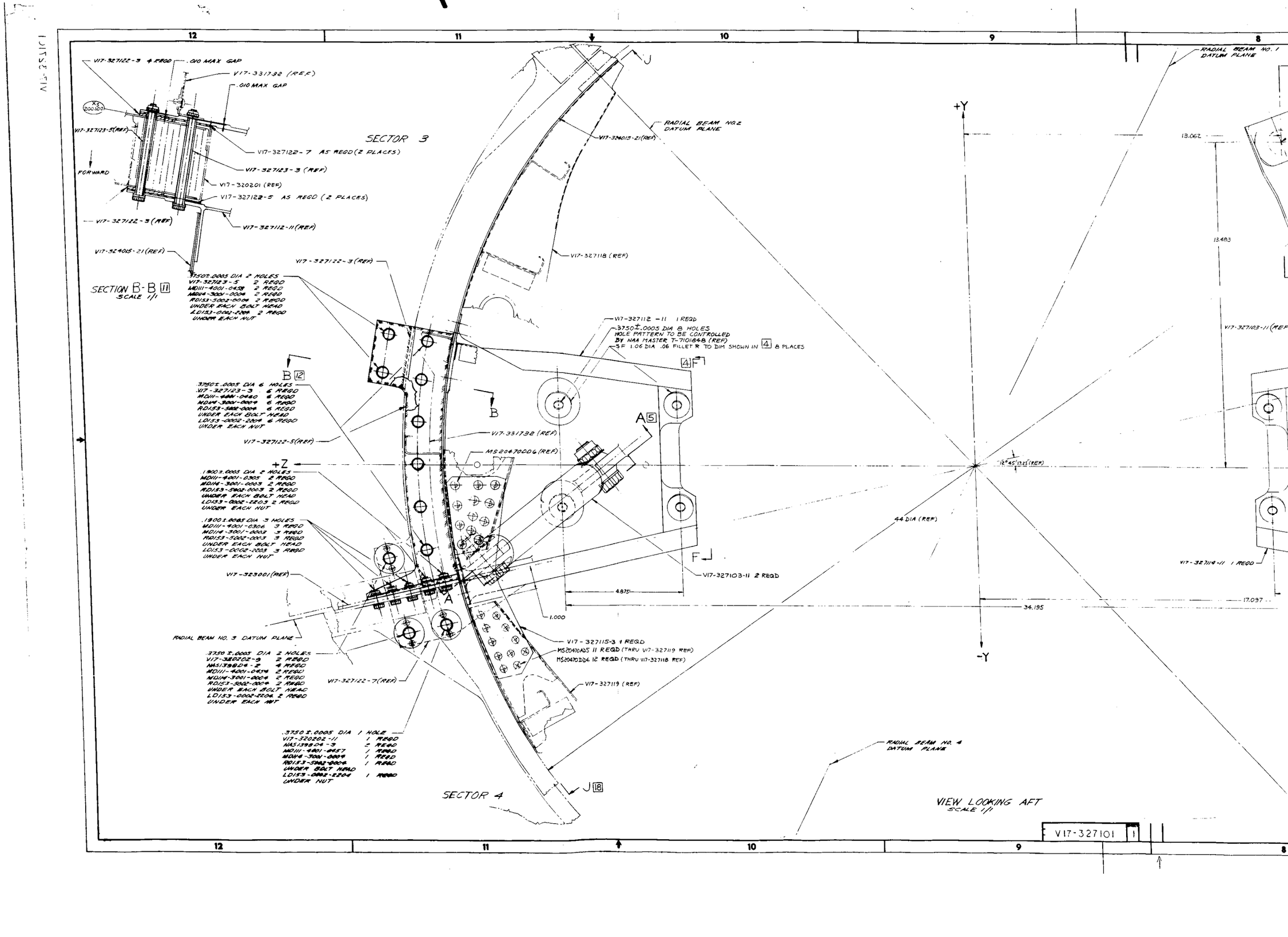
SCALE 1/2 | SHEET

NEXT ASSY	⑦		
USED ON			
114-000024			
PROJECT APPLICATION			
DEPT ART. 178			

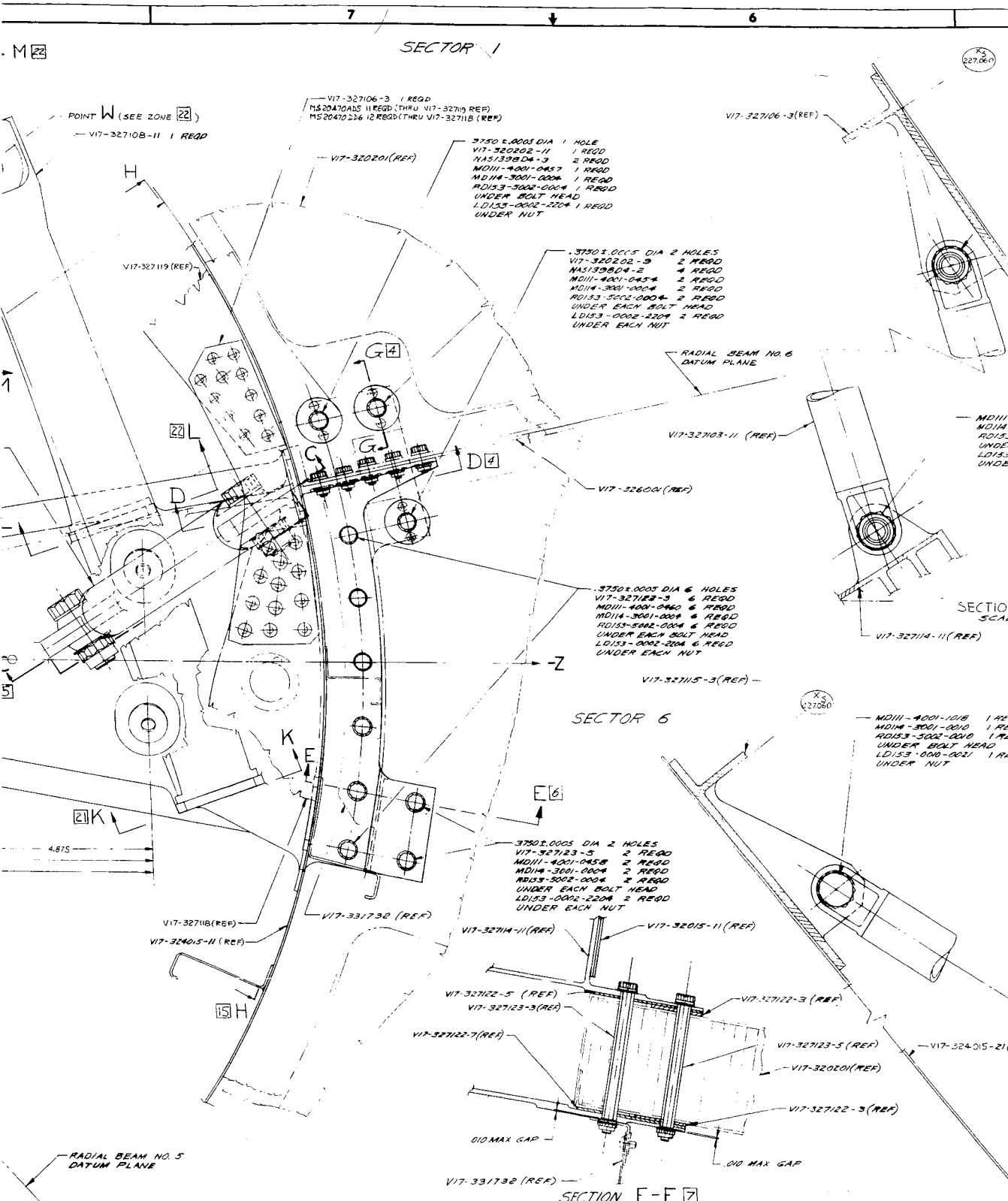
APPLICATION (USAGE) DATA

10 NO ITEM ON THIS DWG REQ TRACEABILITY UNLESS IET CODED T. OR TL.
⑦ 9. HEAT TREAT -3, -4, -15, -16, -16, -17, -18, -19, -33 & -34 TO -T6 COND PER MIL-H-6088 (USAF) -681)
5. BEND RADII .12
6. CHAMFER EDGE .38
8. SYMBOL ⑧ INDICATES WELD SEAMS
[redacted]

Figure 5-15. Mounting Assembly, Propellant and Pressure Tanks, Reaction Control System (VI7-332042)


V17-327122-3 4 REQD
.010 MAX GAP
V17-331732 (REF)
.010 MAX GAP
V17-327123-5(REF)
V17-327122-7 AS REQD (2 PLACES)
V17-327123-3 (REF)
V17-320201 (REF)
V17-327122-5 AS REQD (2 PLACES)
V17-327112-11(REF)
V17-327122-3(REF)
V17-324015-21(REF)
SECTOR 3
RADIAL BEAM NO.2 DATUM PLANE
V17-324015-21(REF)
V17-327118 (REF)
SECTION B-B
SCALE 1/1
.3750±.0005 DIA 2 HOLES
V17-327123-5 2 REQD
MS111-4001-0438 2 REQD
MD114-3001-0008 2 REQD
RD153-5002-0004 2 REQD
UNDER EACH BOLT HEAD
LD153-0001-2004 2 REQD
UNDER EACH NUT
V17-327112-11 1 REQD
.3750±.0005 DIA 8 HOLES
HOLE PATTERN TO BE CONTROLLED
BY NAA MASTER T-7101848 (REF)
SF 1.06 DIA .06 FILLET R TO DIM SHOWN IN 4 8 PLACES
4F
B 12
.3750±.0005 DIA 6 HOLES
V17-327123-3 6 REQD
MD111-4001-0460 6 REQD
MD114-3001-0004 6 REQD
RD153-5002-0004 6 REQD
UNDER EACH BOLT HEAD
LD153-0002-2004 6 REQD
UNDER EACH NUT
B
A 5
V17-331732 (REF)
V17-327122-5(REF)
MS20470DD6(REF)
+Z
.1900±.0005 DIA 2 HOLES
MD111-4001-0305 2 REQD
MD114-3001-0003 2 REQD
RD153-5002-0003 2 REQD
UNDER EACH BOLT HEAD
LD153-0002-2003 2 REQD
UNDER EACH NUT
.1900±.0085 DIA 3 HOLES
MD111-4001-0306 3 REQD
MD114-3001-0003 3 REQD
RD153-5002-0003 3 REQD
UNDER EACH BOLT HEAD
LD153-0002-2003 3 REQD
UNDER EACH NUT
V17-325001(REF)
F
V17-327103-11 2 REQD
4.875
1.000
A
V17-327115-3 1 REQD
MS20470AD5 11 REQD (THRU V17-327119 REF)
MS20470DD6 12 REQD (THRU V17-327118 REF)
V17-327119 (REF)
RADIAL BEAM NO. 3 DATUM PLANE
.3750±.0005 DIA 2 HOLES
V17-380202-9 2 REQD
NAS1398D4-2 4 REQD
MD111-4001-0459 2 REQD
MD114-3001-0004 2 REQD
RD153-5002-0004 2 REQD
UNDER EACH BOLT HEAD
LD153-0002-2004 2 REQD
UNDER EACH NUT
V17-327122-7(REF)
.3750±.0005 DIA 1 HOLE
V17-320202-11 1 REQD
NAS1398D4-3 1 REQD
MD111-4001-0457 1 REQD
MD114-3001-0004 1 REQD
RD153-5002-0004 1 REQD
UNDER BOLT HEAD
LD153-0002-2004 1 REQD
UNDER NUT
SECTOR 4
J 18
RADIAL BEAM NO. 1 DATUM PLANE
+Y
13.062
13.483
V17-327103-11(REF)
12°45' 17.25 (REF)
44 DIA (REF)
V17-327119-11 1 REQD
17.097
34.195
-Y
RADIAL BEAM NO. 4 DATUM PLANE
VIEW LOOKING AFT
SCALE 1/1
V17-327101
1
12
11
10
9
8

2


SECTOR 1
SECTOR 6
POINT W (SEE ZONE 22)
V17-327108-11 1 REQD
V17-327106-3 1 REQD
MS20470AD5 11 REQD (THRU V17-327119 REF)
MS20470D6 12 REQD (THRU V17-327118 REF)
V17-320201 (REF)
.3750±.0005 DIA 1 HOLE
V17-320202-11 1 REQD
NAS1398D4-3 2 REQD
MD111-4001-0457 1 REQD
MD114-3001-0004 1 REQD
RD153-5002-0004 1 REQD
UNDER BOLT HEAD
LD153-0002-2204 1 REQD
UNDER NUT
V17-327119 (REF)
.3750±.0005 DIA 2 HOLES
V17-320202-3 2 REQD
NAS1398D4-2 4 REQD
MD111-4001-0454 2 REQD
MD114-3001-0004 2 REQD
RD153-5002-0004 2 REQD
UNDER EACH BOLT HEAD
LD153-0002-2204 2 REQD
UNDER EACH NUT
V17-327106-3 (REF)
RADIAL BEAM NO. 6 DATUM PLANE
V17-327103-11 (REF)
V17-326004 (REF)
.3750±.0005 DIA 6 HOLES
V17-327122-3 6 REQD
MD111-4001-0460 6 REQD
MD114-3001-0004 6 REQD
RD153-5002-0004 6 REQD
UNDER EACH BOLT HEAD
LD153-0002-2204 6 REQD
UNDER EACH NUT
V17-327114-11 (REF)
V17-327115-3 (REF)
MD111-4001-1018 1 REQD
MD114-3001-0010 1 REQD
RD153-5002-0010 1 REQD
UNDER BOLT HEAD
LD153-0010-0021 1 REQD
UNDER NUT
.3750±.0005 DIA 2 HOLES
V17-327123-5 2 REQD
MD111-4001-0458 2 REQD
MD114-3001-0004 2 REQD
RD153-5002-0004 2 REQD
UNDER EACH BOLT HEAD
LD153-0002-2204 2 REQD
UNDER EACH NUT
V17-327118 (REF)
V17-324015-11 (REF)
V17-331732 (REF)
V17-327114-11 (REF)
V17-320015-11 (REF)
V17-327122-5 (REF)
V17-327123-3 (REF)
V17-327122-7 (REF)
V17-327122-3 (REF)
V17-327123-5 (REF)
V17-320201 (REF)
V17-327122-3 (REF)
.010 MAX GAP
.010 MAX GAP
V17-331732 (REF)
RADIAL BEAM NO. 5 DATUM PLANE
SECTION E-E 7
SCALE 1/1
4.875
H
G 4
G
D 4
D
22 L
-Z
K
E
E 6
21 K
15 H

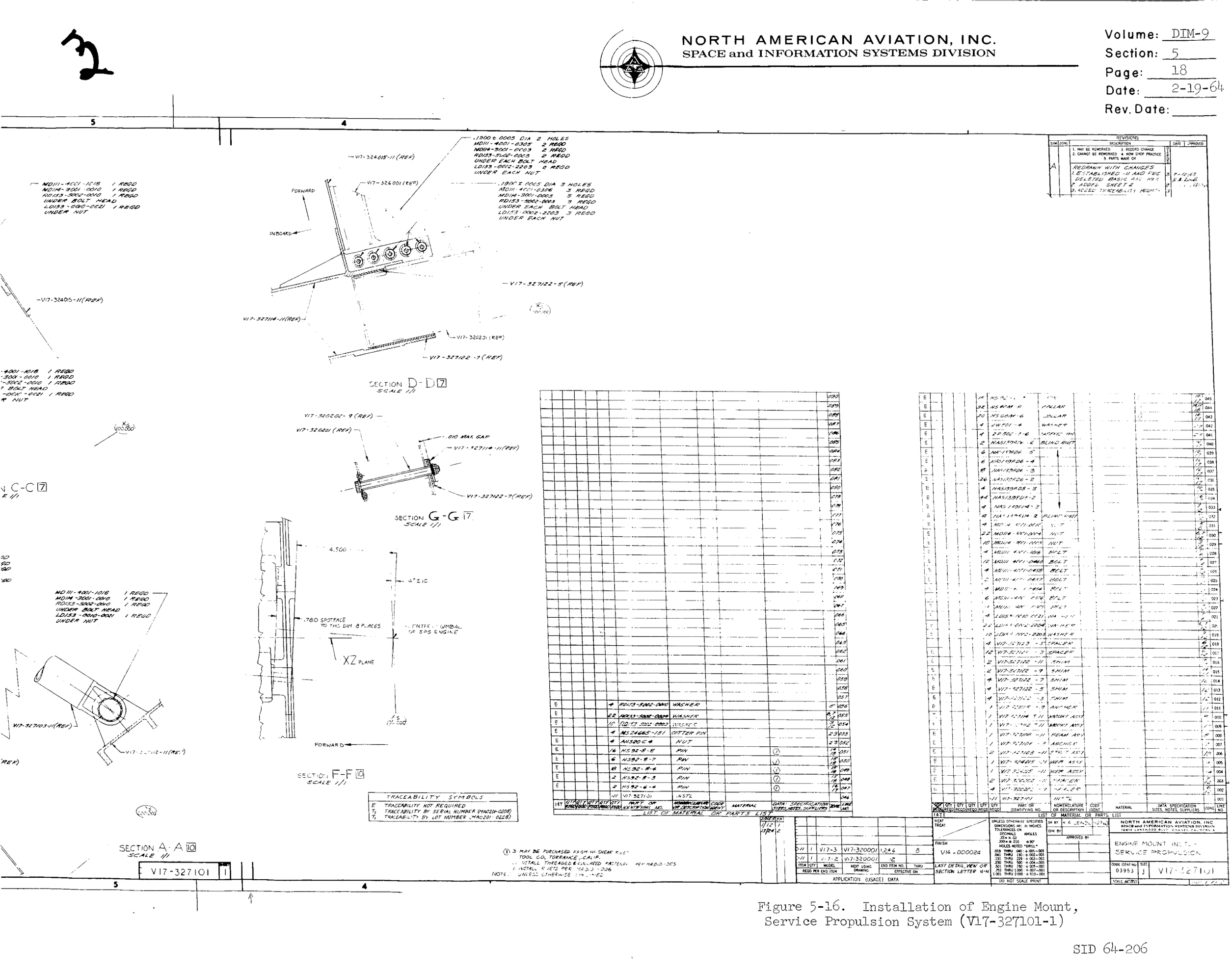
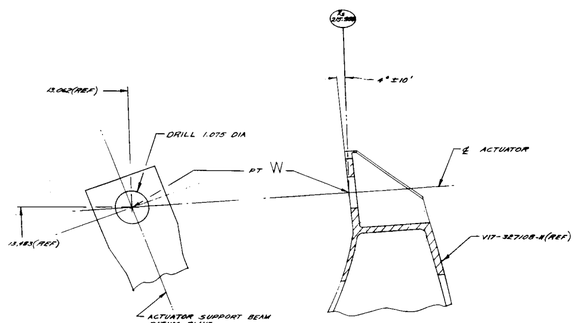
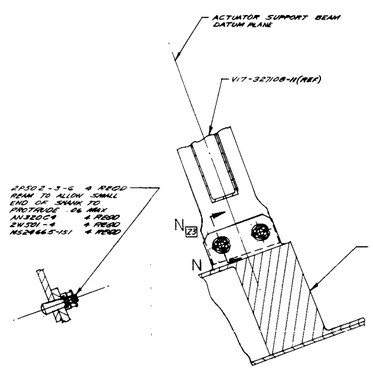


Figure 5-16. Installation of Engine Mount, Service Propulsion System (V17-327101-1)



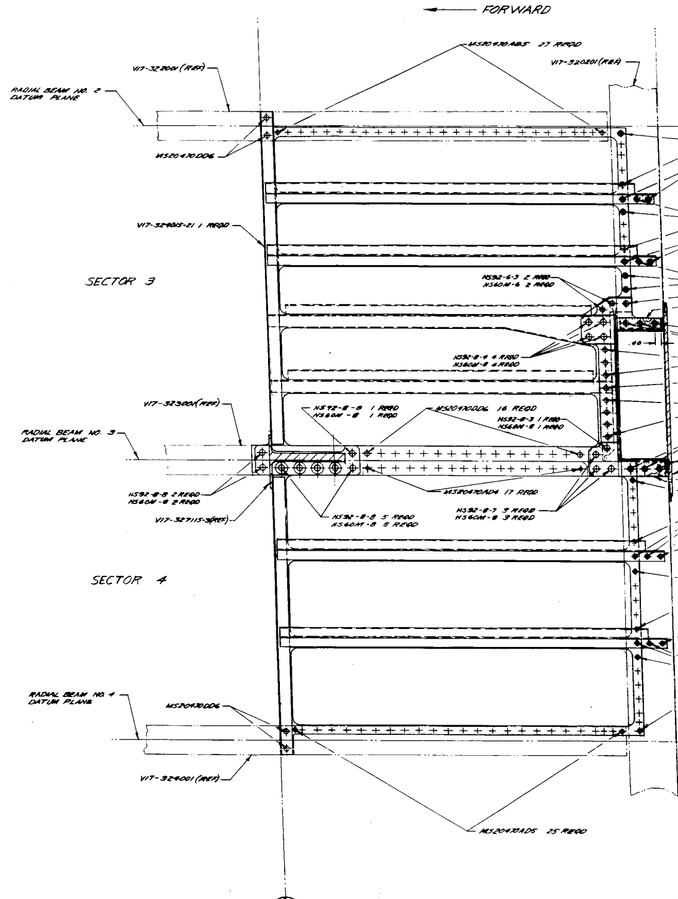
SECTION M-M
SCALE 1/1



SECTION K-K
SCALE 1/1

SECTION N-N
SCALE 1/1

SECTION L-L
SCALE 1/1



SECTION J-J
SCALE 1/2

REVISIONS			
SYM	ZONE	DESCRIPTION	DATE	APPROVED
A		1. MAY BE REWORKED 2. CANNOT BE REWORKED 3. RECORD CHANGE 4. NOW SHOP PRACTICE 5. PARTS MADE OK SEE SHEET 1		

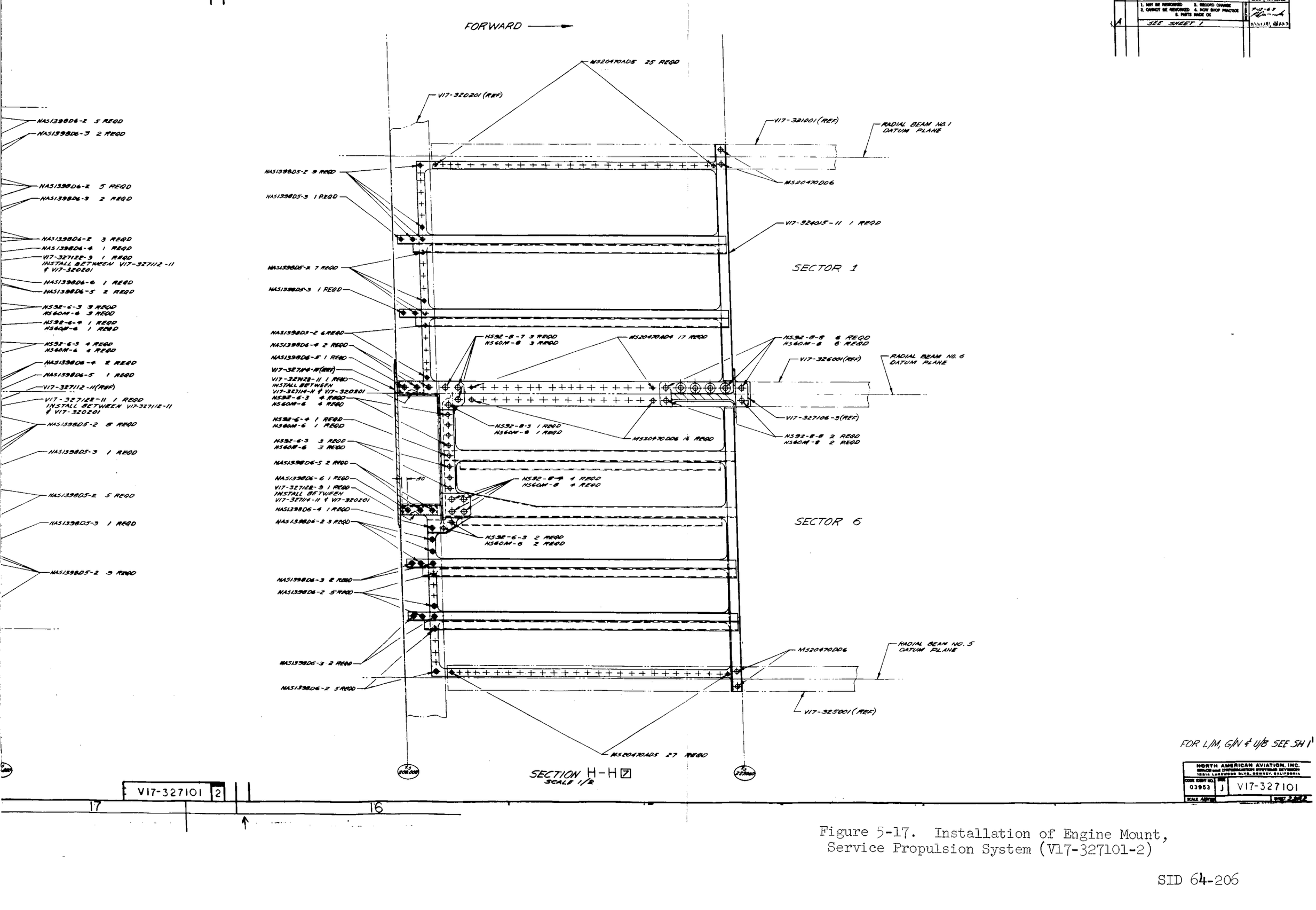
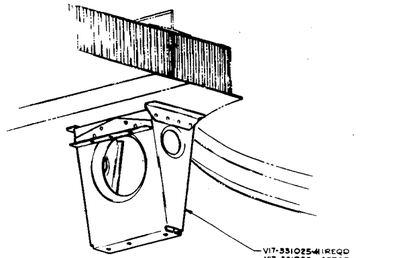
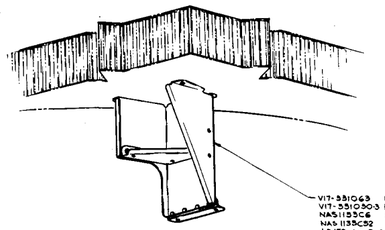


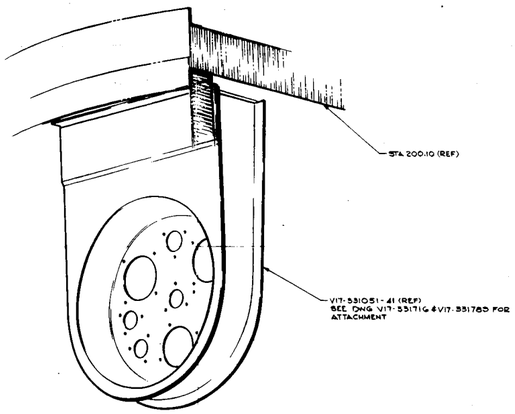
Figure 5-17. Installation of Engine Mount, Service Propulsion System (V17-327101-2)



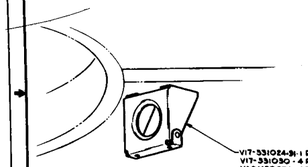
VIEW D-D 6



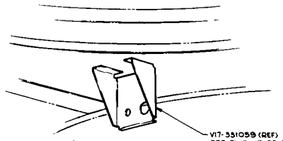
VIEW C-C 5



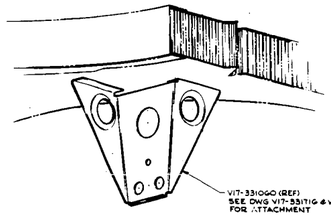
VIEW B-B 3



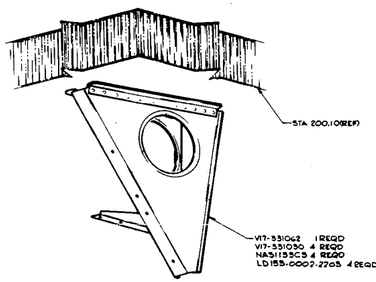
VIEW F-F 6



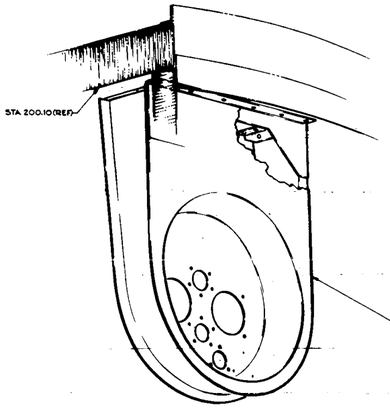
VIEW E-E 6



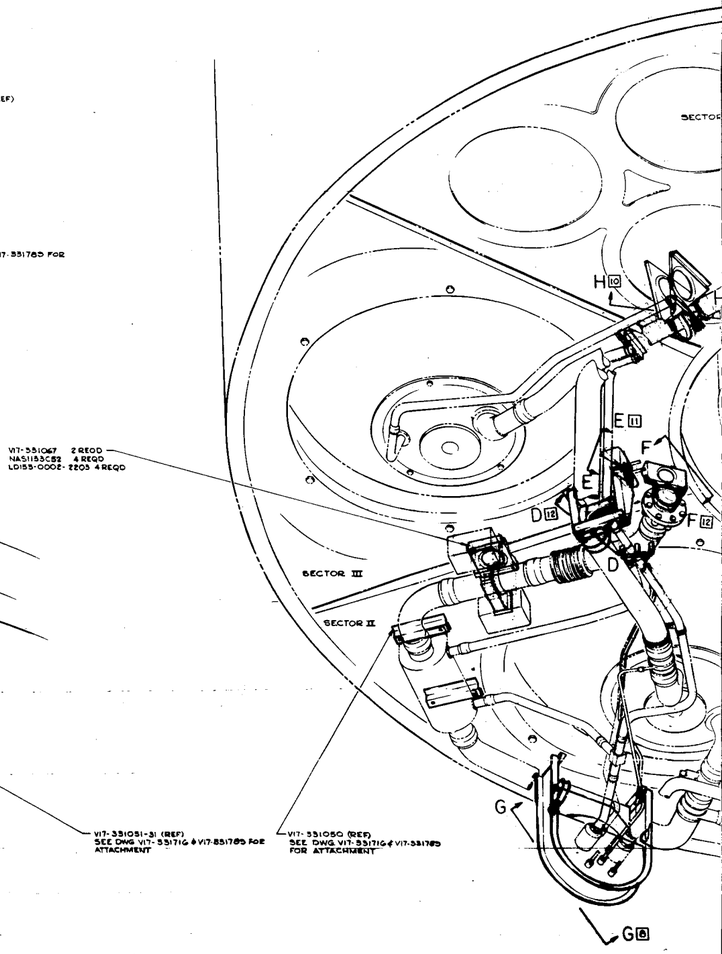
VIEW J-J 4

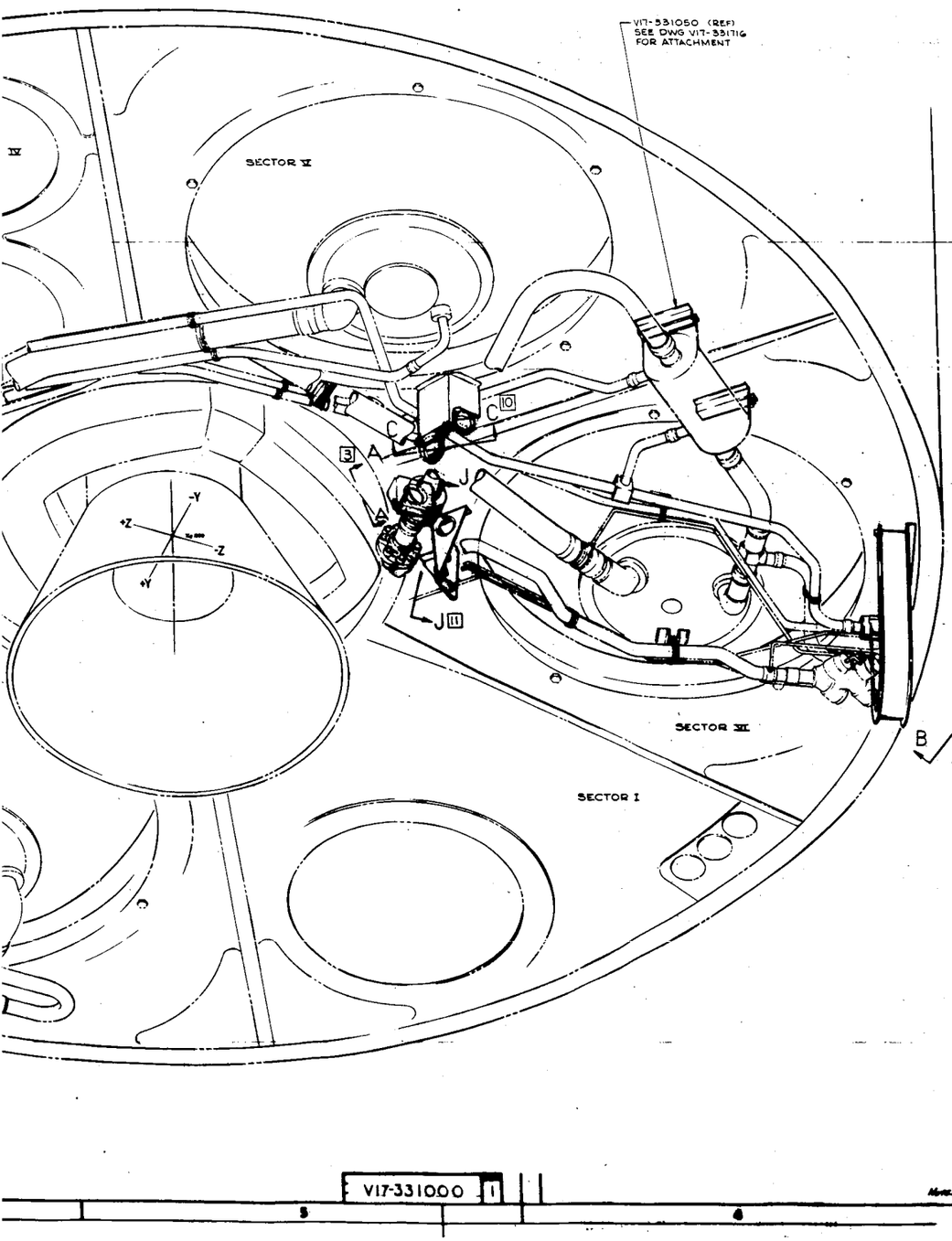


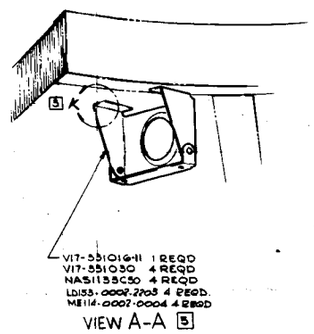
VIEW H-H 6

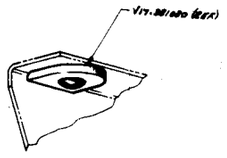


VIEW G-G 8









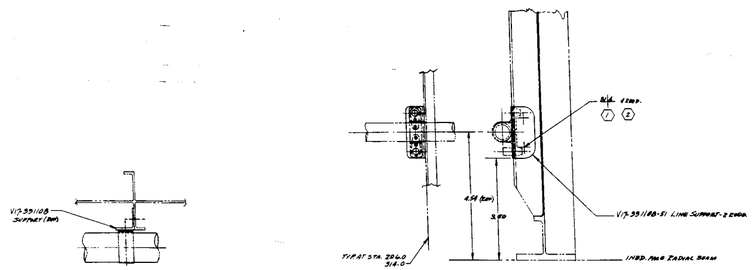
ITEM	QTY	PART NO.	DESCRIPTION
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13		MS24693C53	SCREW
4		MS24693C69	SCREW
3		MS24693C6	SCREW
17		ME114-0002-0004	NUT
4		NAS1133C3	SCREW
25		LD133-0002-2203	WASHER
5		V17-331030-8	WASHER
1		V17-331067	BRACKET
16		V17-331030	WASHER
1		V17-331025-41	SUPPORT
1		V17-331024-31	
1		V17-331016-11	
1		V17-331068	
1		V17-331063	SUPPORT
REF		V17-331000	INSTALLATION

ITEM	QTY	PART NO.	DESCRIPTION
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2	1	V17-3	

MOUNTING PROVISIONS INSTALLATION SERVICE PROPELLANT SYSTEM

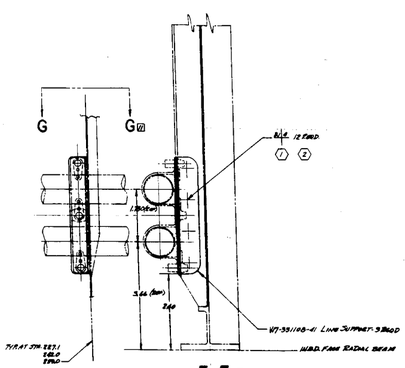
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Figure 5-18. Mounting Provisions Installation, Service Propulsion System (V17-331000)

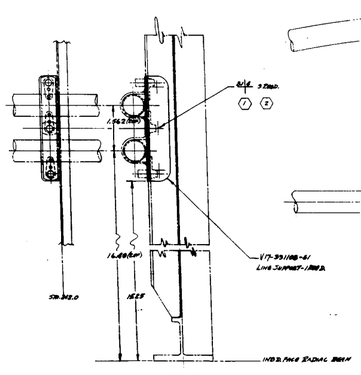


VIEW G-G
TYP LINE SUPPORT

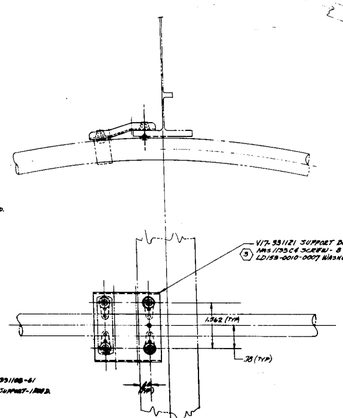
SECTION D-D



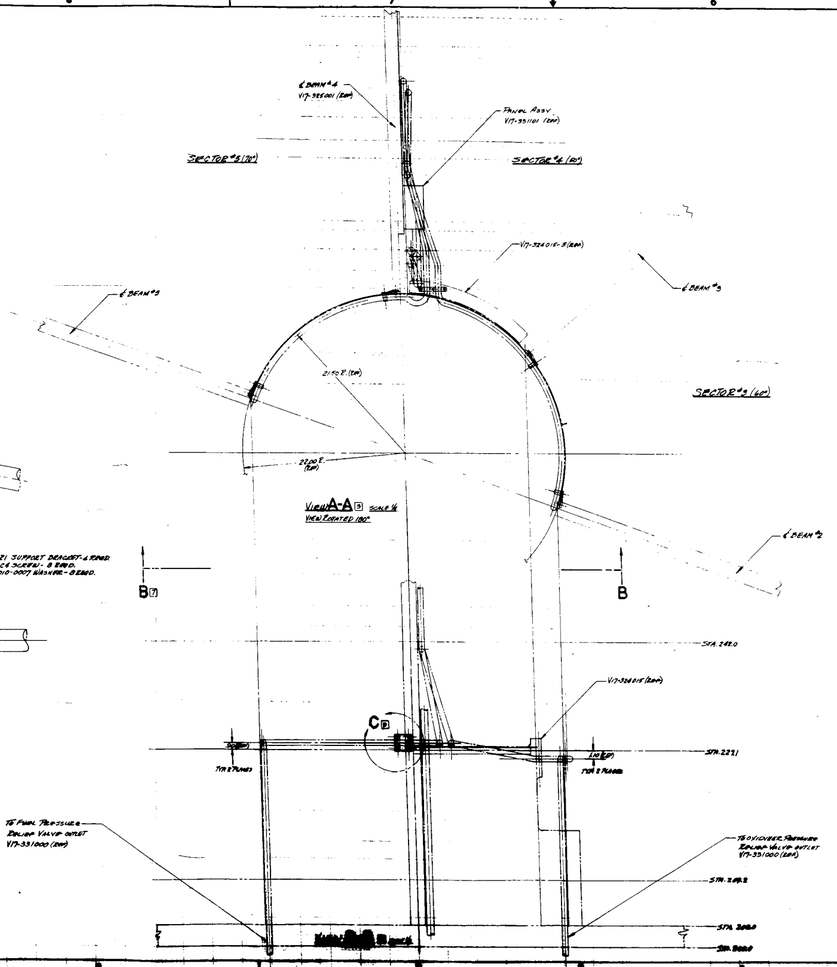
SECTION E-E



SECTION F-F



VIEW C
TYPICAL 4 PLACES



VIEW A-A SCALE ½
VIEW ROTATED 180°

V17-331100

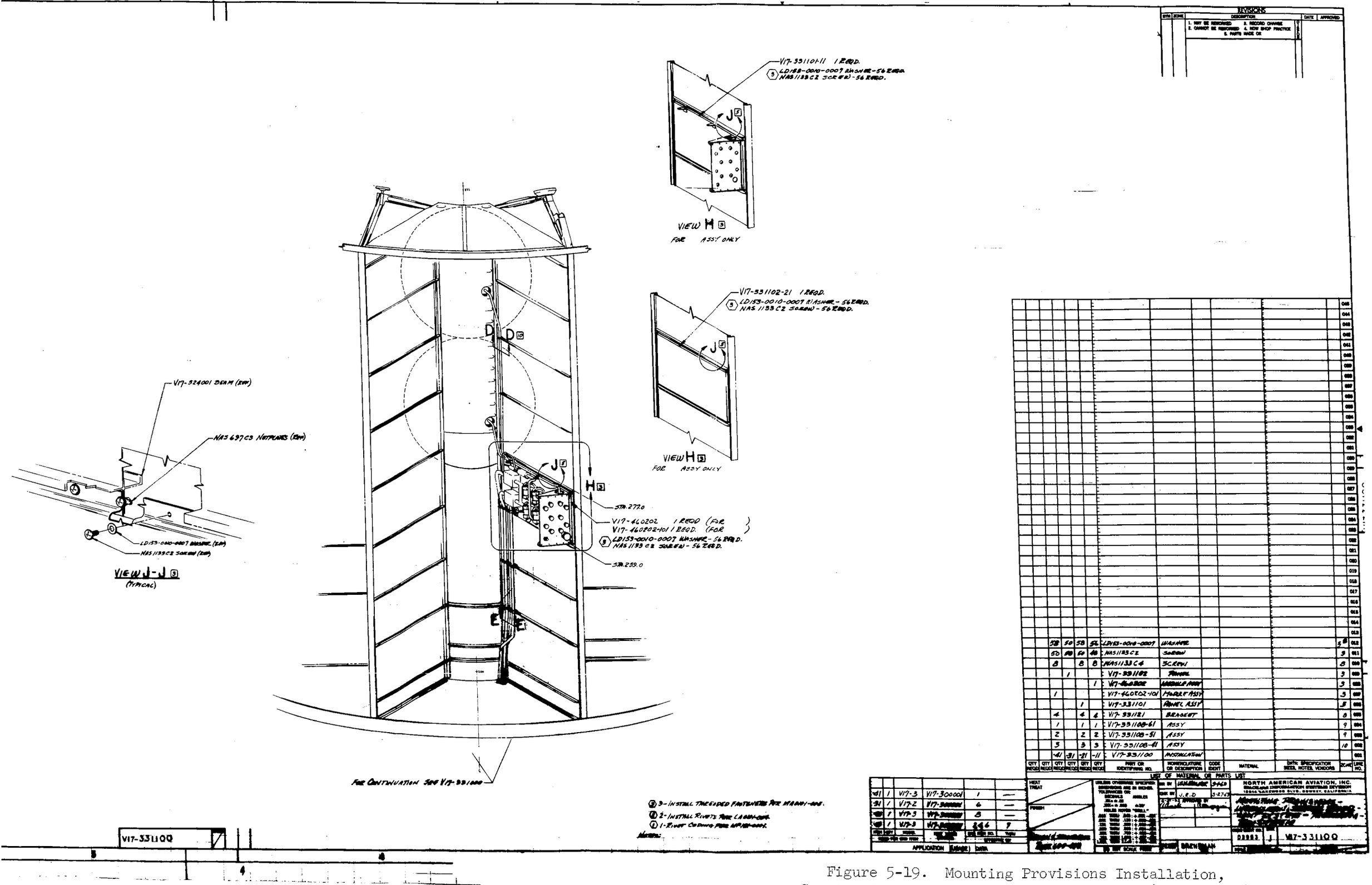


Figure 5-19. Mounting Provisions Installation, Service Propulsion Pressurization System (V17-331100)

5.5 EPS Mounting Provisions Configuration

5.5.1 The over-all view of the EPS mounting provisions for the installation of the fuel cells and related equipment is the purpose of drawing V17-331552 (Figures 5-20 through 5-21). Sheet one of this drawing is a perspective of the installation. The fuel cell itself is mounted by means of a stabilized shear web as seen in drawing V17-331524 (Figure 5-22).

5.5.2 Both the LH_2 and LO_2 bottles in Sector One serve the EPS. The manner of mounting the LO_2 bottles is stated in 5.2.2. Mounting of the upper LH_2 tank is shown in drawing V17-331566 (Figure 5-23). See Figures 2-10 through 2-13 for provisions made for the lower LH_2 tank.

5.5.3 Proposed mounting of the space radiators of the EPS is depicted in layout V17-933074 (Figure 5-24).

5.5.4 Hard lines and valves which supply liquid oxygen and liquid hydrogen to the fuel cells are mounted in Sector Four as illustrated by drawing V17-331553 (Figures 5-25 through 5-27). Supports for other lines which supply glycol fill to the EPS radiators include blocks, line mountings, saddle clamps, and clips.

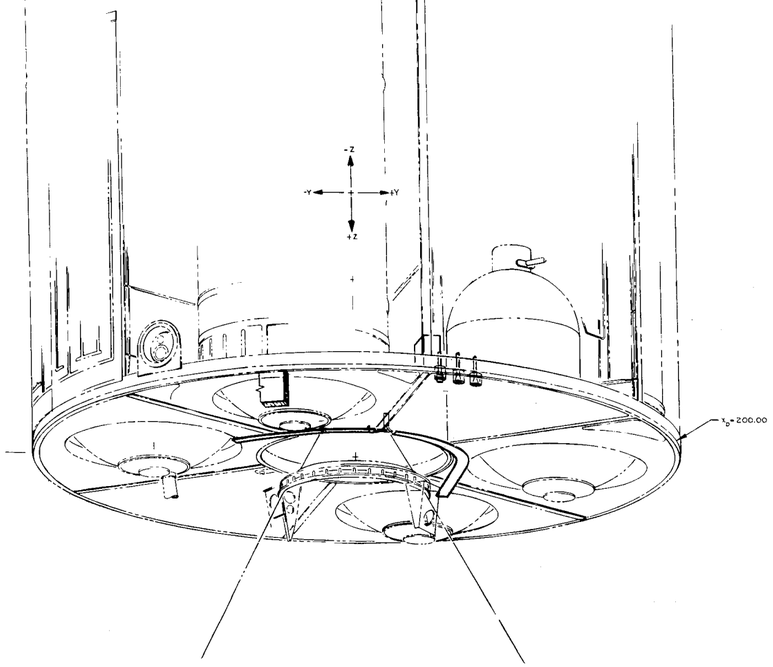
5.5.5 EPS control is accomplished by an electric power box mounted by a bracket.

5.5.6 Wire harness for the EPS is supported by channel blocks, clips, angles, and brackets.

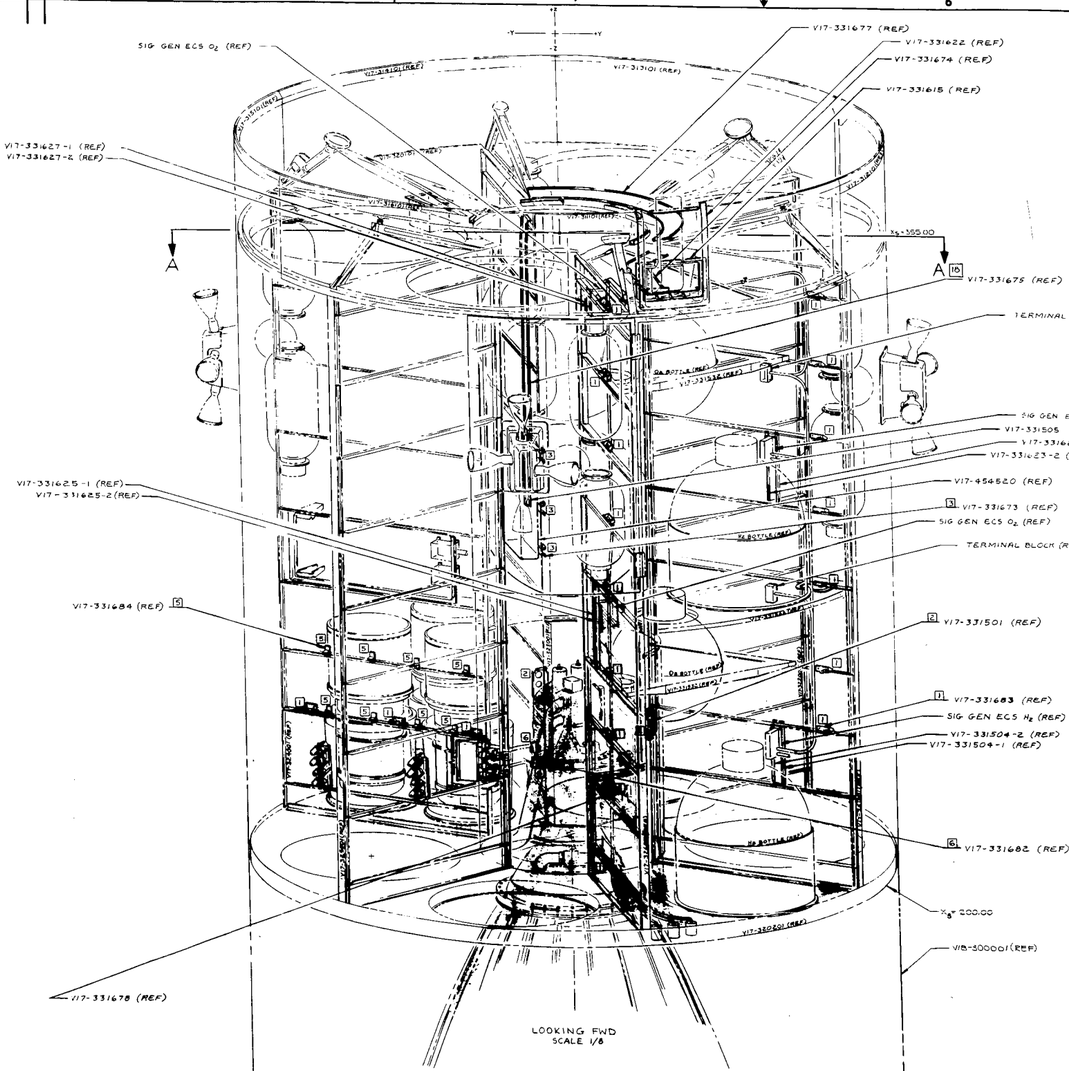
5.6 T.S. Mounting Provisions Configuration

5.6.1 A drawing of the installation provisions for the telecommunication system is unobtainable at this time.

5.6.2 Mountings for the wire harness and wave guide of this system are similar to those noted in 5.5.6.



LOOKING FWD
SCALE 1/8



LOOKING FWD
SCALE 1/8

V17-331552 1

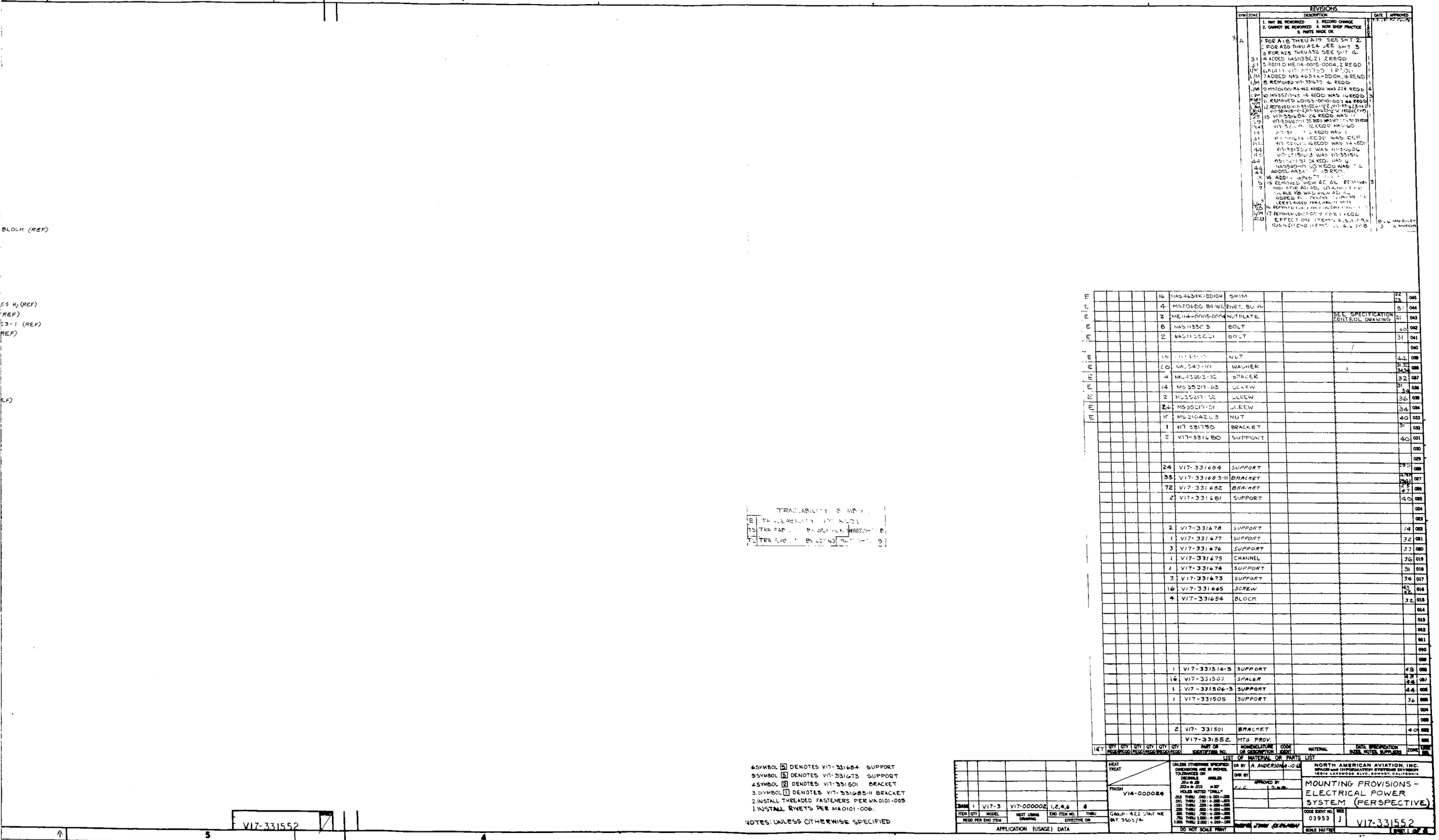
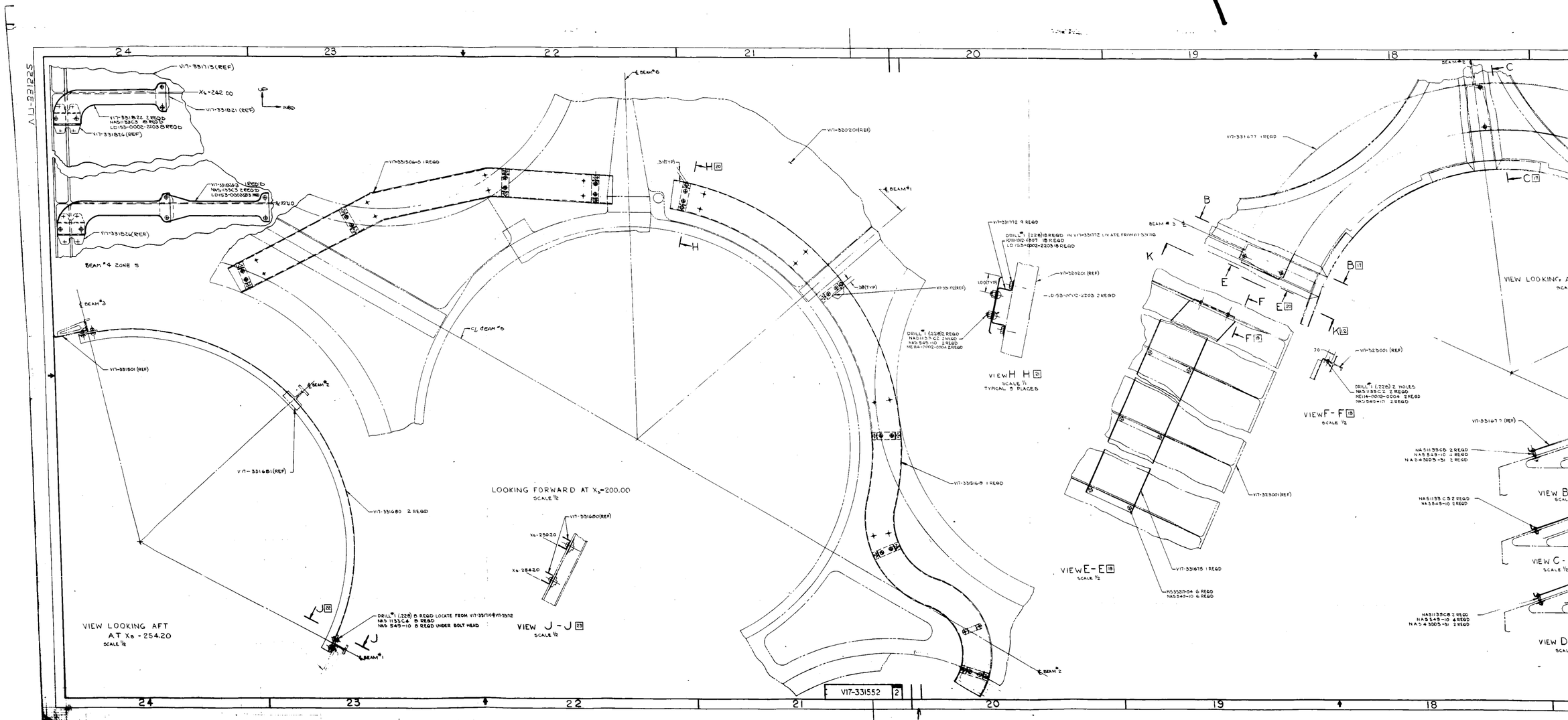


Figure 5-20. Mounting Provisions, Electrical Power System (V17-331552-1)


V17-331552
2
BEAM #4 ZONE 5
VIEW LOOKING AFT AT Xs - 254.20
SCALE 1/2
LOOKING FORWARD AT Xs=200.00
SCALE 1/2
VIEW J-J
SCALE 1/2
VIEW H H
SCALE 1/1
TYPICAL 5 PLACES
VIEW E-E
SCALE 1/2
VIEW F-F
SCALE 1/2
VIEW LOOKING
VIEW B
VIEW C
VIEW D
V17-331713(REF)
V17-331822 2 REQD
V17-331824(REF)
V17-331823 1 REQD
V17-331824(REF)
V17-331506-5 1 REQD
V17-331501(REF)
V17-331680 2 REQD
V17-331680(REF)
V17-331516-9 1 REQD
V17-331677 1 REQD
V17-331675 1 REQD
V17-323001(REF)
V17-331677 (REF)
BEAM #1
BEAM #2
BEAM #3
BEAM #4
BEAM #5
BEAM #6
24
23
22
21
20
19
18

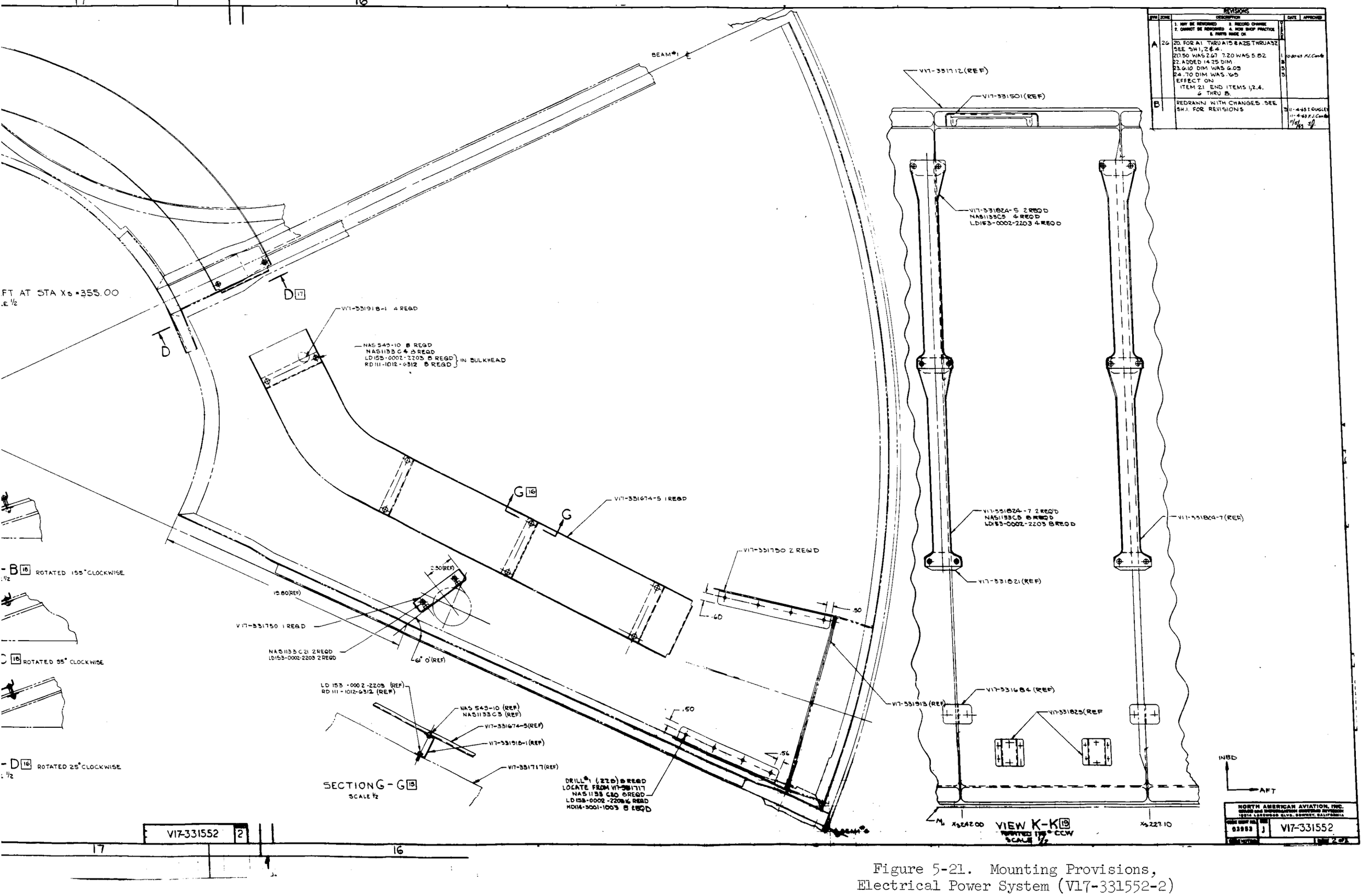
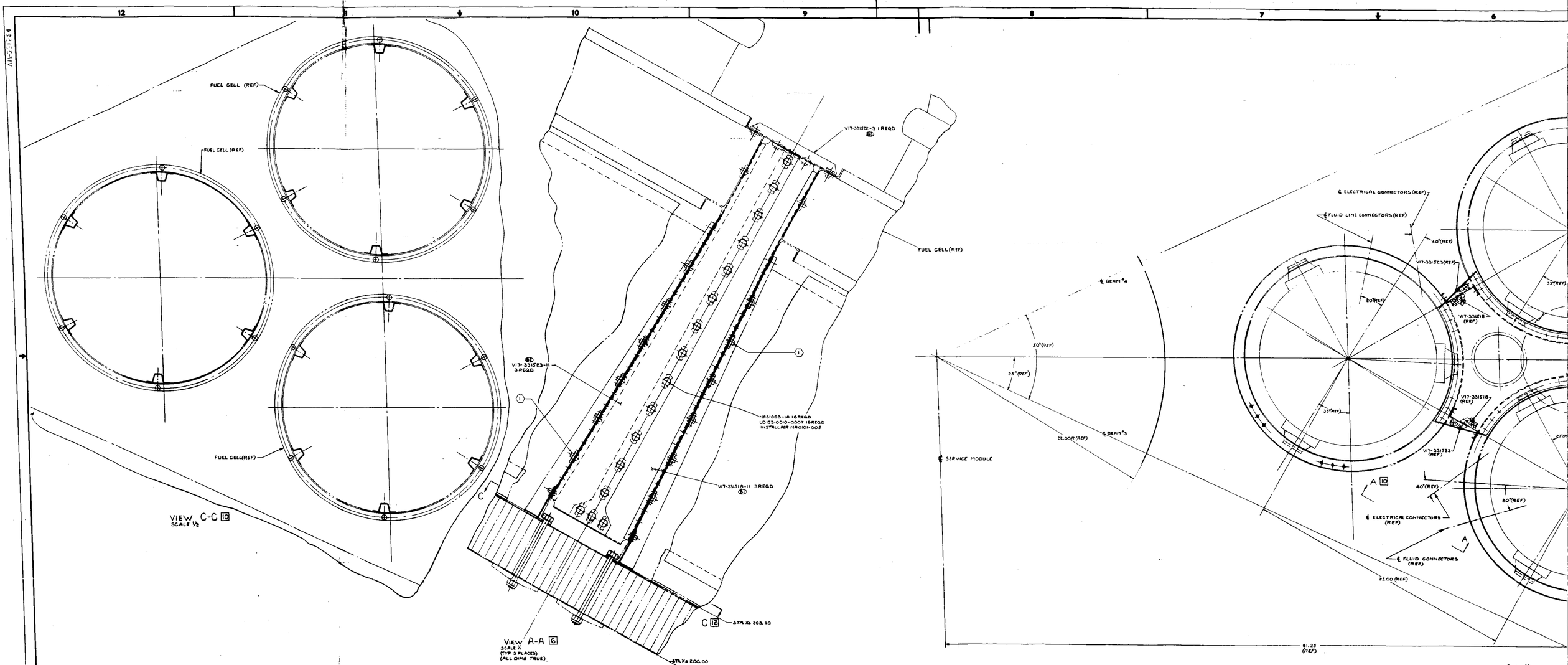


Figure 5-21. Mounting Provisions, Electrical Power System (V17-331552-2)


FUEL CELL (REF)
FUEL CELL (REF)
FUEL CELL(REF)
VIEW C-C 10
SCALE 1/2
V17-331522-3 1 REQD
FUEL CELL(REF)
V17-331523-11 3 REQD
NAS1003-1A 16 REQD
LD153-0010-0007 16 REQD
INSTALLER MAGIDI-005
V17-331518-11 3 REQD
C
C 12
STA. X= 203.10
VIEW A-A 6
SCALE 1/2
(TYP 3 PLACES)
(ALL DIMS TRUE)
STA. X= 200.00
℄ ELECTRICAL CONNECTORS (REF)
℄ FLUID LINE CONNECTORS (REF)
40° (REF)
V17-331523 (REF)
20° (REF)
V17-331518 (REF)
33° (REF)
℄ BEAM #4
50° (REF)
25° (REF)
℄ BEAM #3
22.00 R (REF)
℄ SERVICE MODULE
A 10
℄ ELECTRICAL CONNECTORS (REF)
℄ FLUID CONNECTORS (REF)
A
23.00 (REF)
81.25 (REF)
SCALE 1/2

VIP-331524

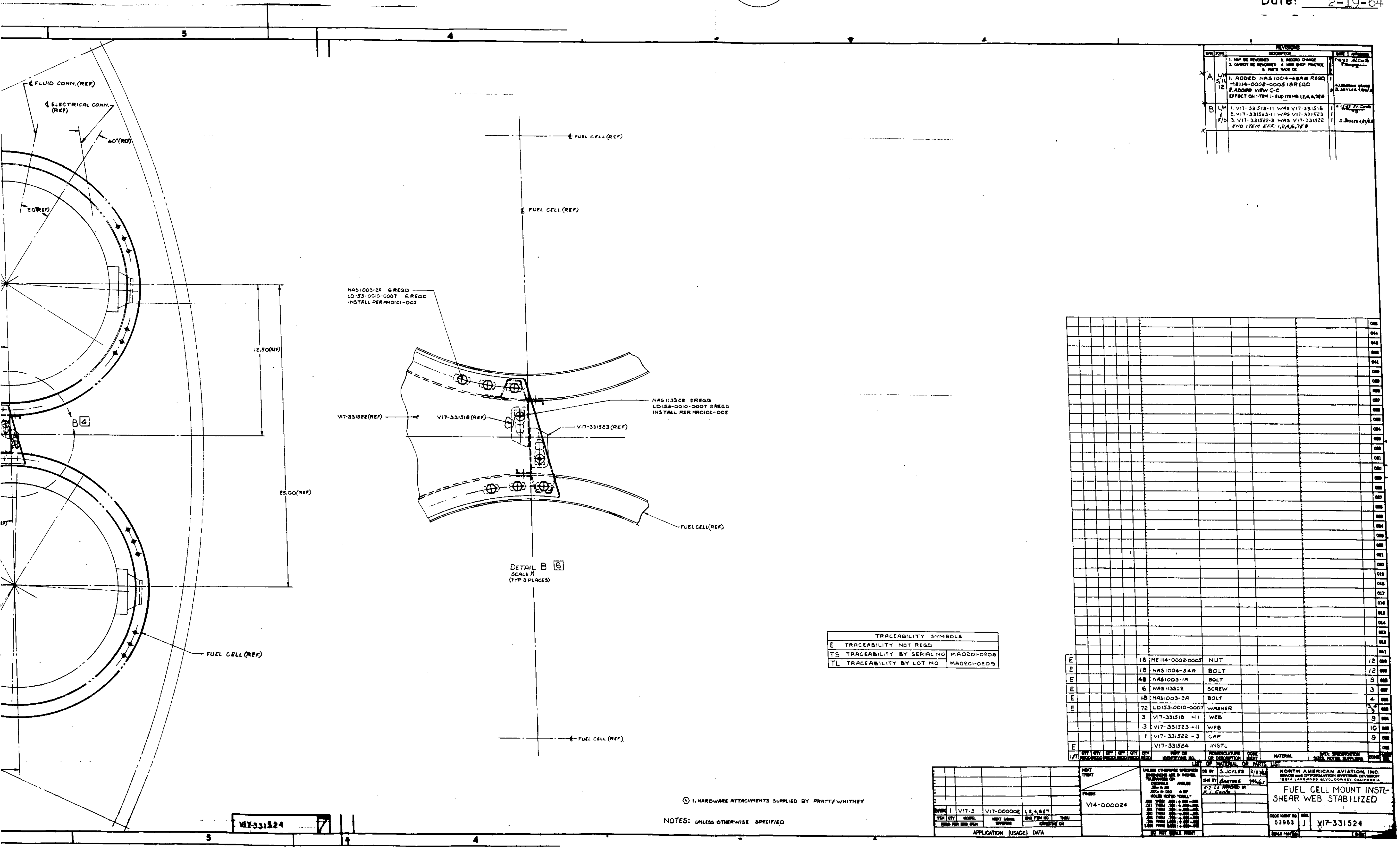
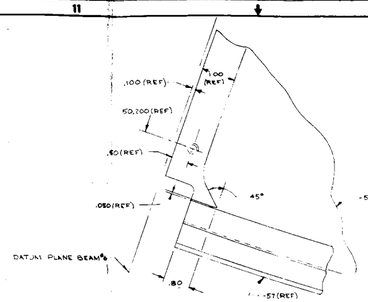
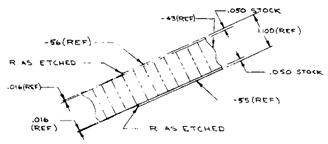


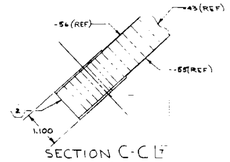
Figure 5-22. Installation of Fuel-Cell Mounting, Stabilized Shear Web (V17-331524)



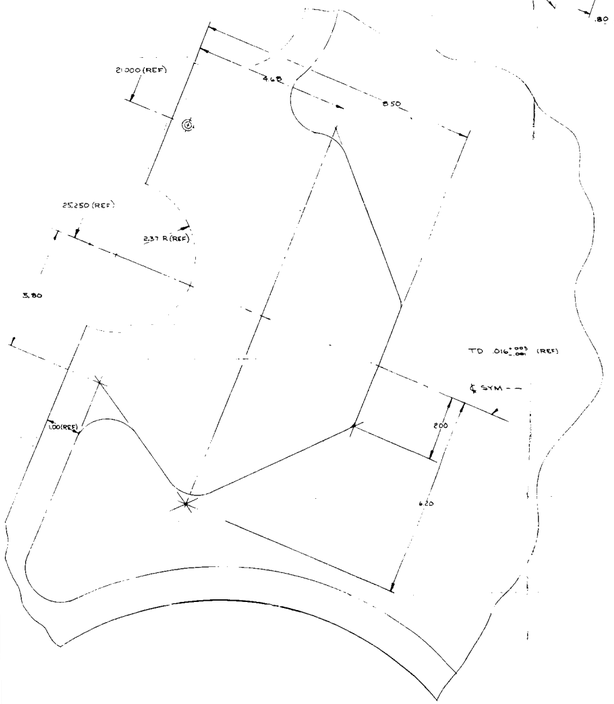
DETAIL E 5
SCALE 1/1



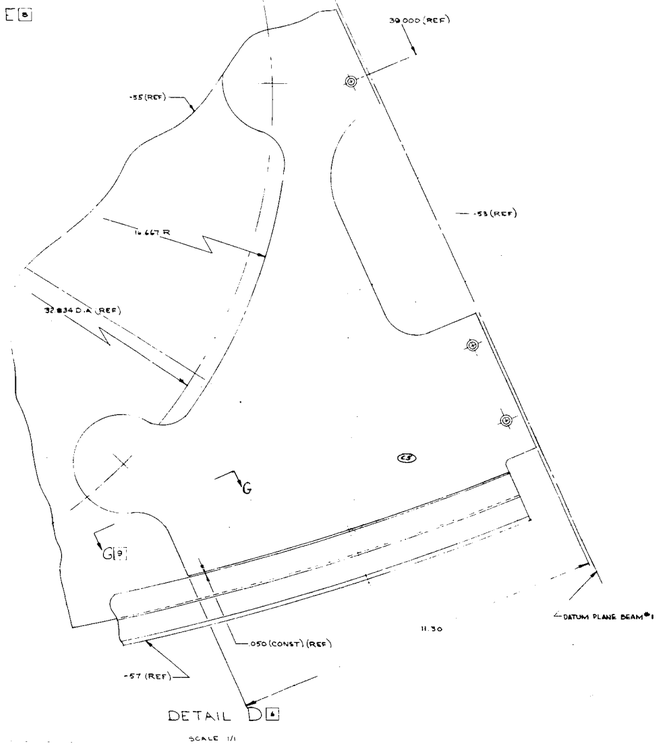
SECTION G-G 10
SCALE 1/1



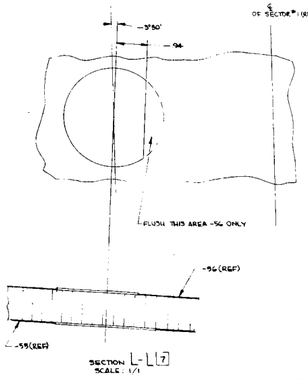
SECTION C-C 17
SCALE 1/1



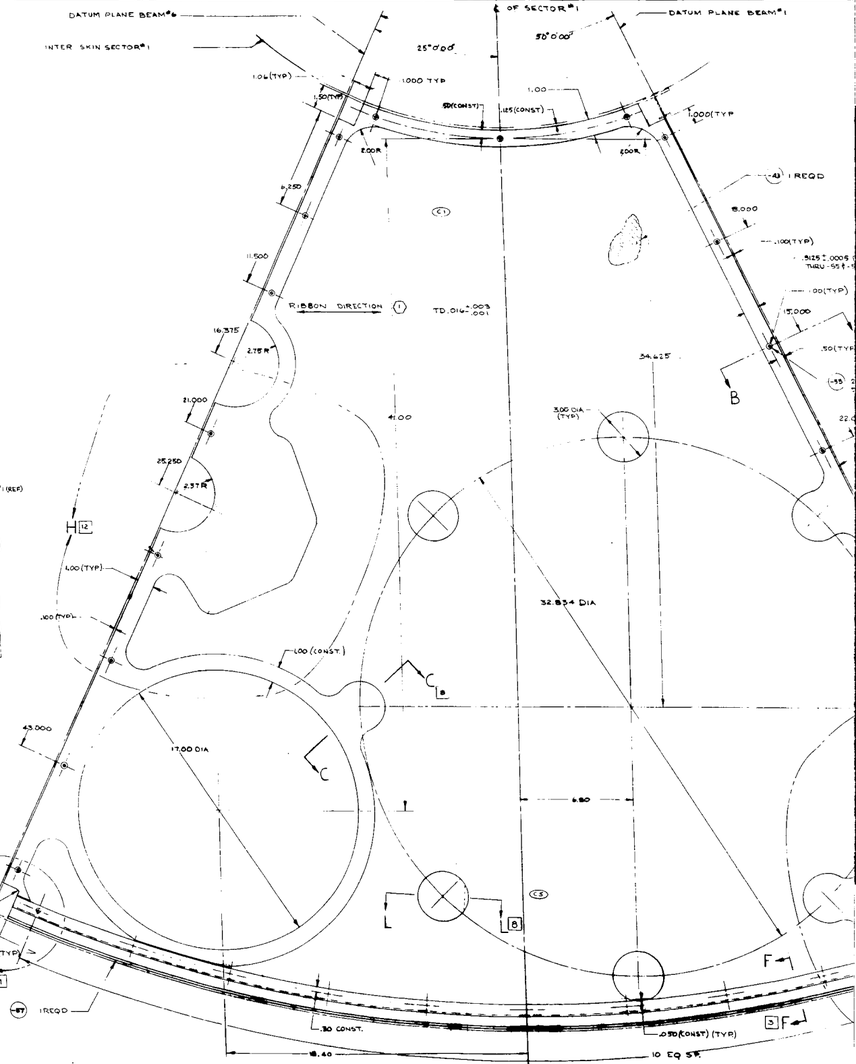
DETAIL H 7
SCALE 1/1



DETAIL D 4
SCALE 1/1



SECTION L-L 17
SCALE 1/1



VI7-3315GG

VI7-3315GG

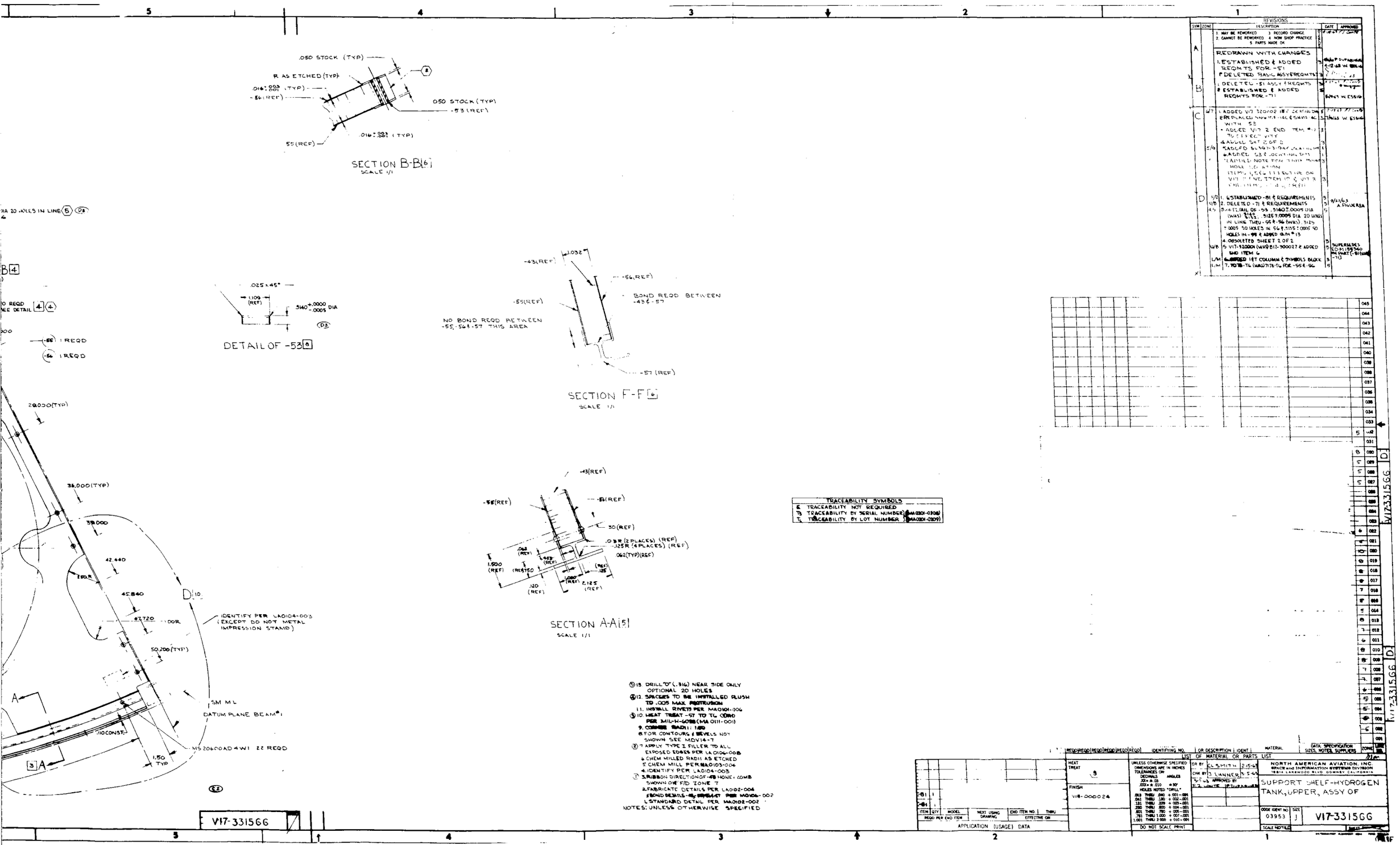
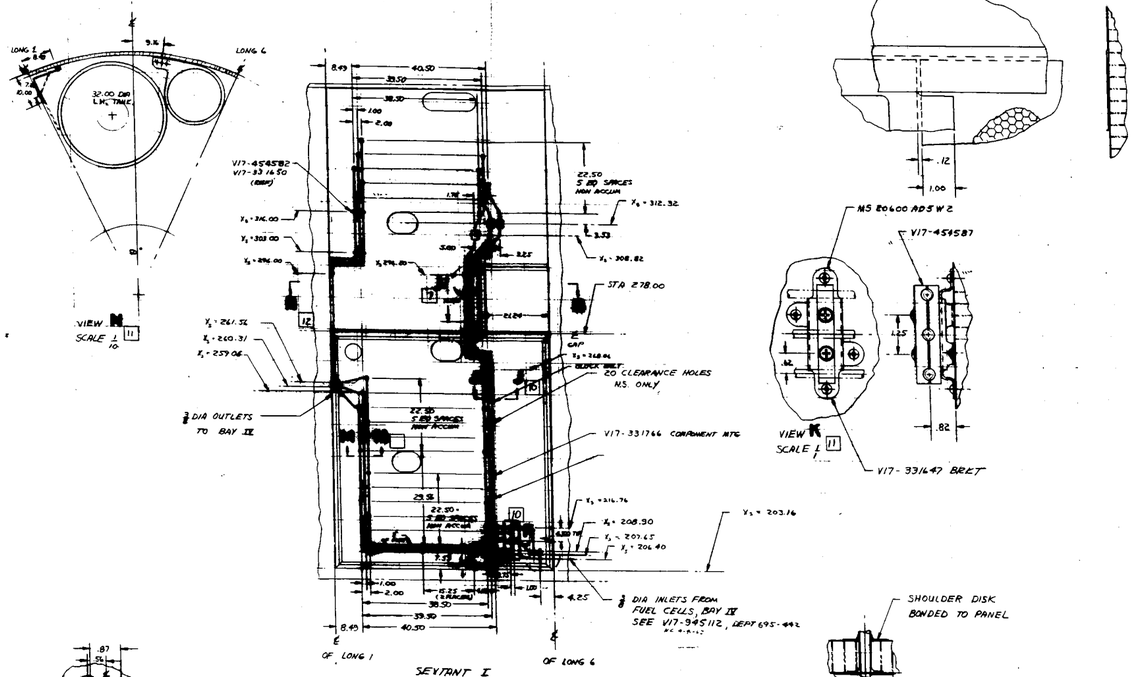


Figure 5-23. Assembly of Support Shelf, Upper Hydrogen Tank (V17-331566)

SID 64-206


VIEW M
SCALE 1/8
VIEW M
SCALE 1/10
SEXTANT I
FLAT PATTERN
OF LONG 1
OF LONG 6
VIEW K
SCALE 1/1
SECTION J-J
SCALE 1/1
(TYP FOR RADIATOR PORTS, SECTIONS I & II)
SHOULDER DISK BONDED TO PANEL
VIEW G
SCALE 1/8
SECTION M-M
SCALE 1/1
DETAIL
SCALE 1/1
SEXTANT I
(FLAT PATTERN)
SECTION K-K
SCALE 1/1
SECTION F-F
SCALE 1/8
VIEW L
SCALE 1/1
SEXTANT IV
(FLAT PATTERN)
LONG 1
LONG 6
OF LONG 4
OF LONG 5

V17-933074

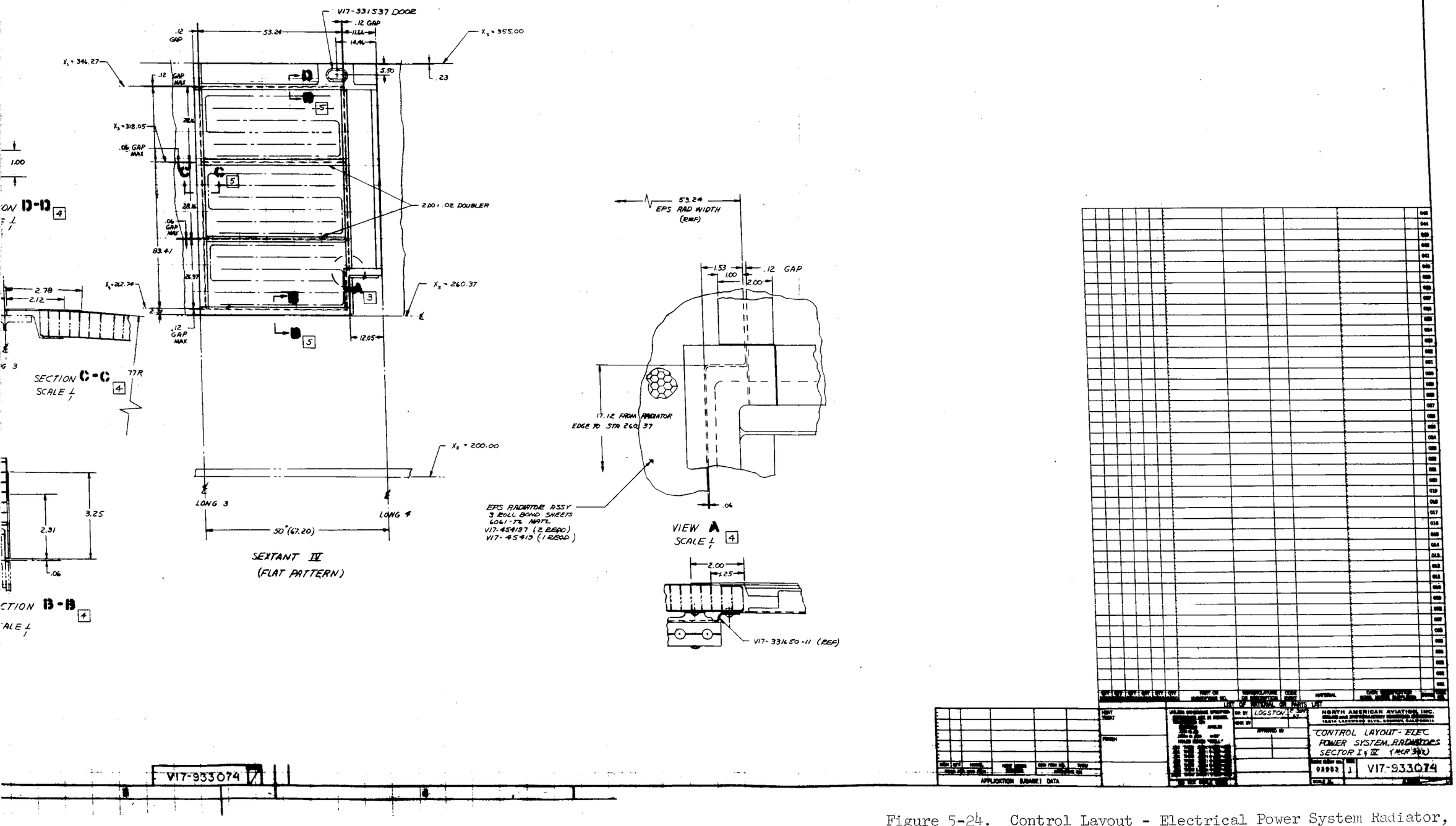
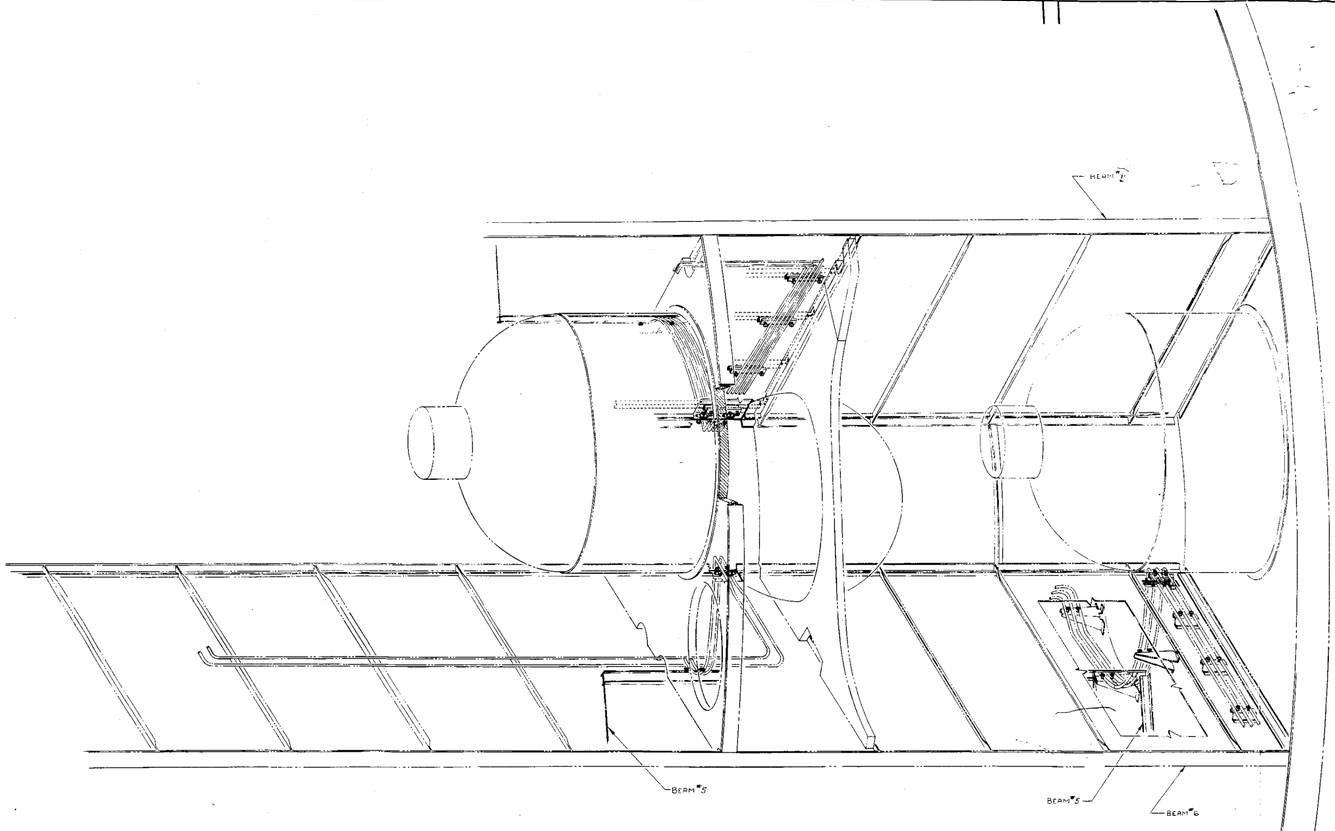
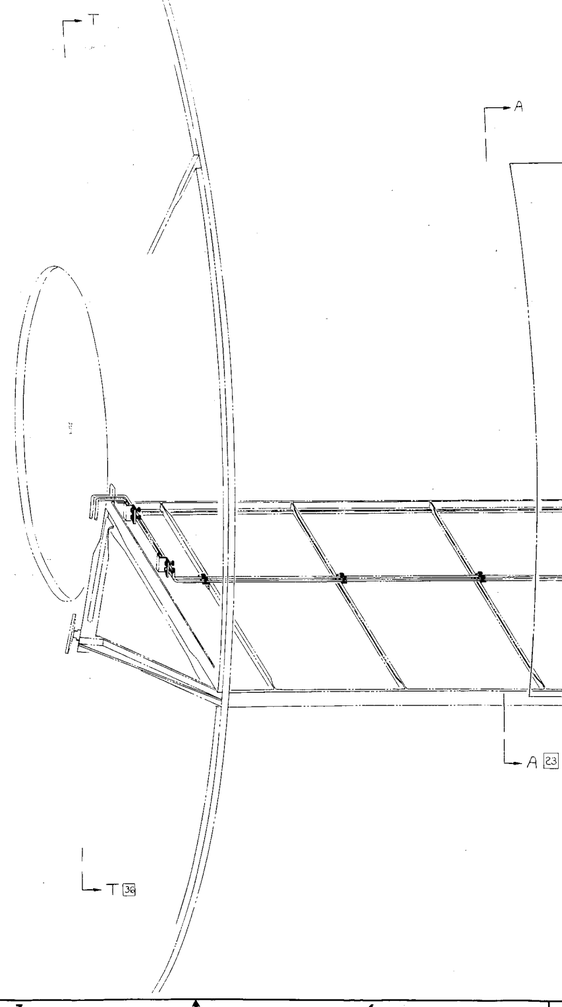


Figure 5-24. Control Layout - Electrical Power System Radiator, Sectors One and Four (V17-933074)

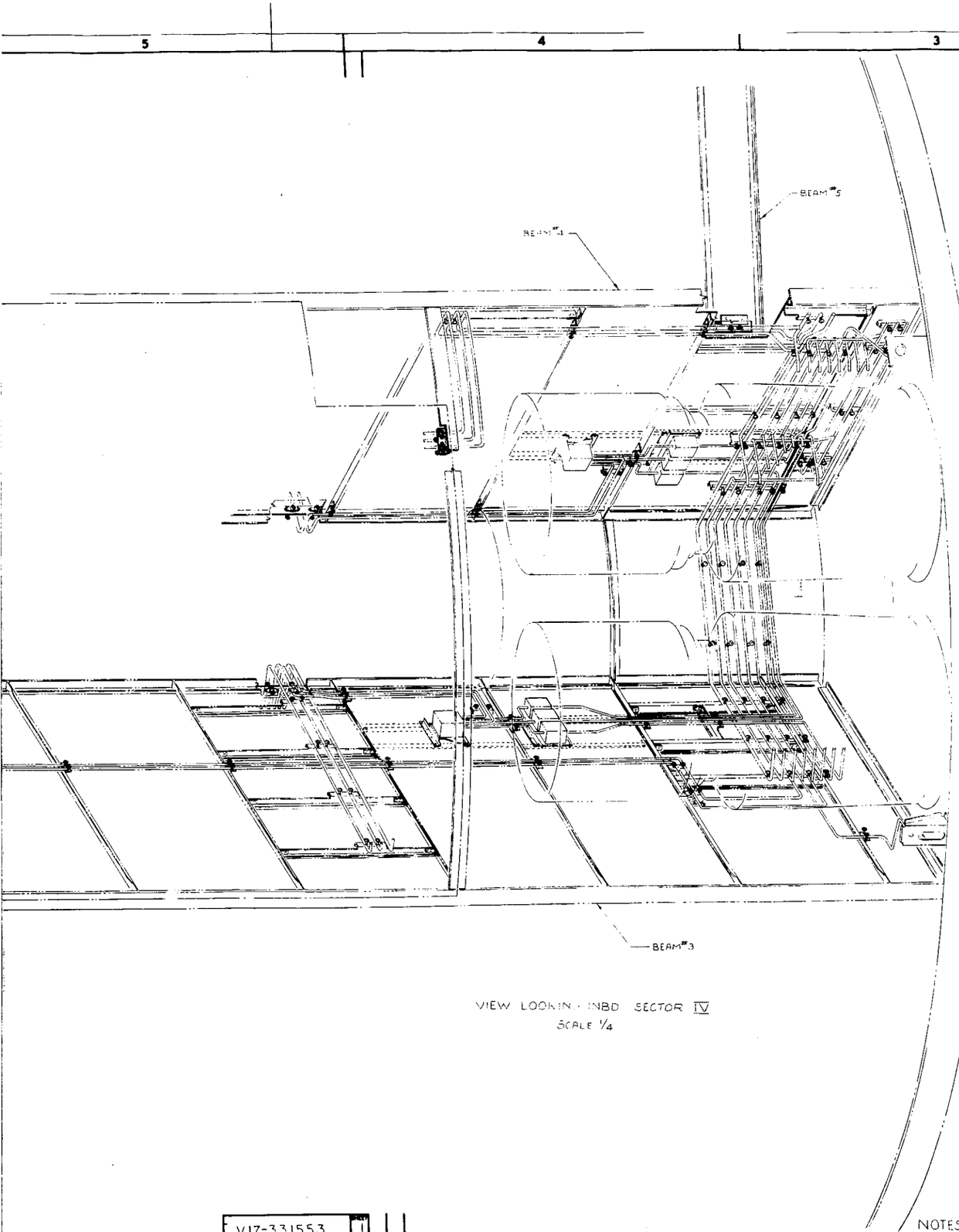


VIEW LOOKING INBD SECTOR I

SCALE 1/4



V17-331553



NOTES: UNLESS OTHERWISE SPECIFIED
1. INSTALL FASTENERS PER MA0101-005
2. INSTALL RIVETS PER MA0101-006

QTY REQD/REQD	QTY REQD/REQD	QTY REQD/REQD	QTY REQD/REQD	QTY REQD/REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT	MATERIAL	DATA: SPECIFICATION SIZES, NOTES, SUPPLIERS	ZONE	LINE NO.
				6	LD153-0002-2204	WASHER				24	006
				6	ME114-0002-0004	NUT				24	005
				6	NAS1003-32A	BOLT				24	004
				1	V17-331549-3	BRACKET				24	003
				1	V17-331734	SUPPORT				24	002
					V17-331553	INSTL					001

LIST OF MATERIAL OR PARTS LIST

REVISIONS					
SYM	ZONE	DESCRIPTION		DATE	APPROVED
		1. MAY BE REWORKED 2. CANNOT BE REWORKED 3. RECORD CHANGE 4. NOW SHOP PRACTICE 5. PARTS MADE OK			
X			0 1 2		

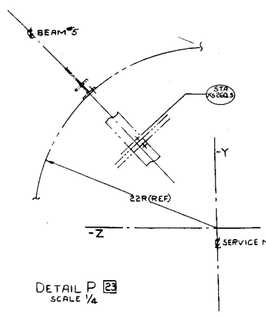
HEAT TREAT	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ON: DECIMALS .XX = ±.01 .XXX = ±.010 ANGLES ±30' HOLES NOTED "DRILL" .219 THRU .240 : +.001 -.001 .241 THRU .190 : +.008 -.001 .191 THRU .329 : +.005 -.001 .330 THRU .500 : +.004 -.001 .501 THRU .750 : +.006 -.001 .751 THRU 1.000 : +.007 -.001 1.001 THRU 2.000 : +.010 -.001	DR BY S. HOYT 5-31-3	NORTH AMERICAN AVIATION, INC. SPACE and INFORMATION SYSTEMS DIVISION 12214 LAKEWOOD BLVD. DOWNEY, CALIFORNIA
FINISH V14-000024		CHK BY APPD BY	FLUID LINES SUPPORT INSTL- ELEC POWER SYSTEM, PROVISIONS FOR	
		PROJ ENGR	CODE IDENT NO 03953 SIZE J V17-331553	
		DO NOT SCALE PRINT	SCALE NOTED SHEET 2 OF 3	

BASIC ITEM	QTY REQD PER END ITEM	MODEL	NEXT USING DRAWING	END ITEM NO. EFFECTIVE ON	THRU
BASIC	1	V17-3	V17-000003	1,2,4,6	8

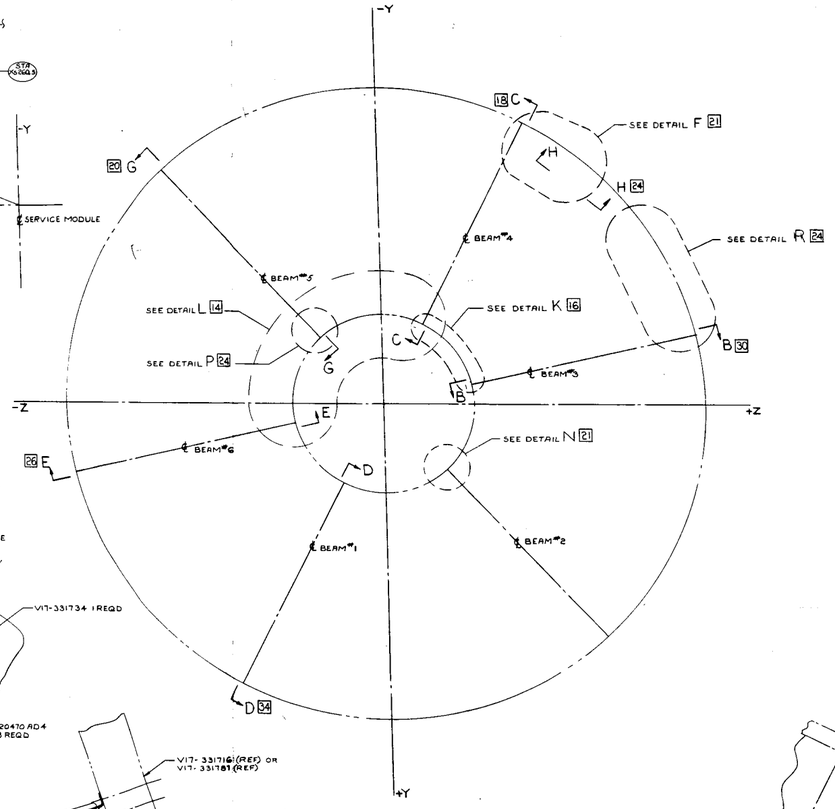
APPLICATION (USAGE) DATA

V17-331553 SHEET 1

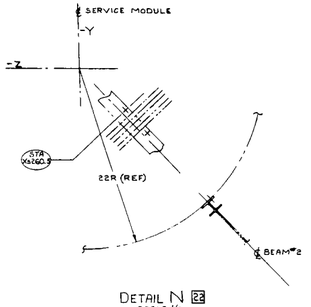
Figure 5-25. Installation Provisions, Fluid Lines Support, Electrical Power System (V17-331553-1)



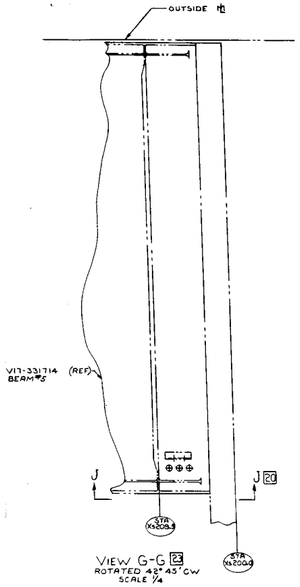
DETAIL P 23
SCALE 1/4



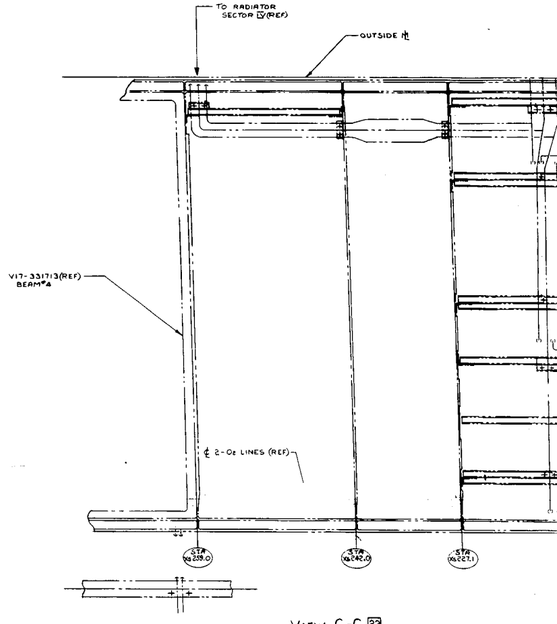
VIEW A-A 6
ROTATED 37°45' CCW
SCALE 1/8
VIEW LOOKING AFT



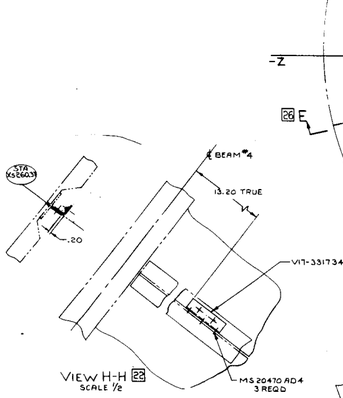
DETAIL N 22
SCALE 1/4



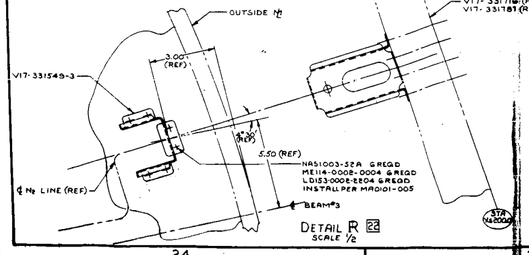
VIEW G-G 23
ROTATED 48°45' CW
SCALE 1/4



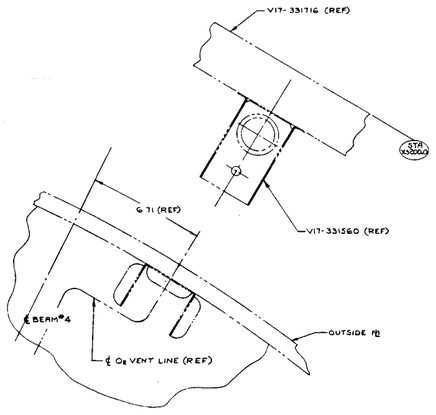
VIEW C-C 22
ROTATED 27°15' CCW
SCALE 1/4



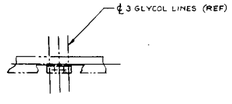
VIEW H-H 22
SCALE 1/2



DETAIL R 22
SCALE 1/2



DETAIL F 22
SCALE 1/2



VIEW J-J 20
SCALE 1/4

V17-331553 7

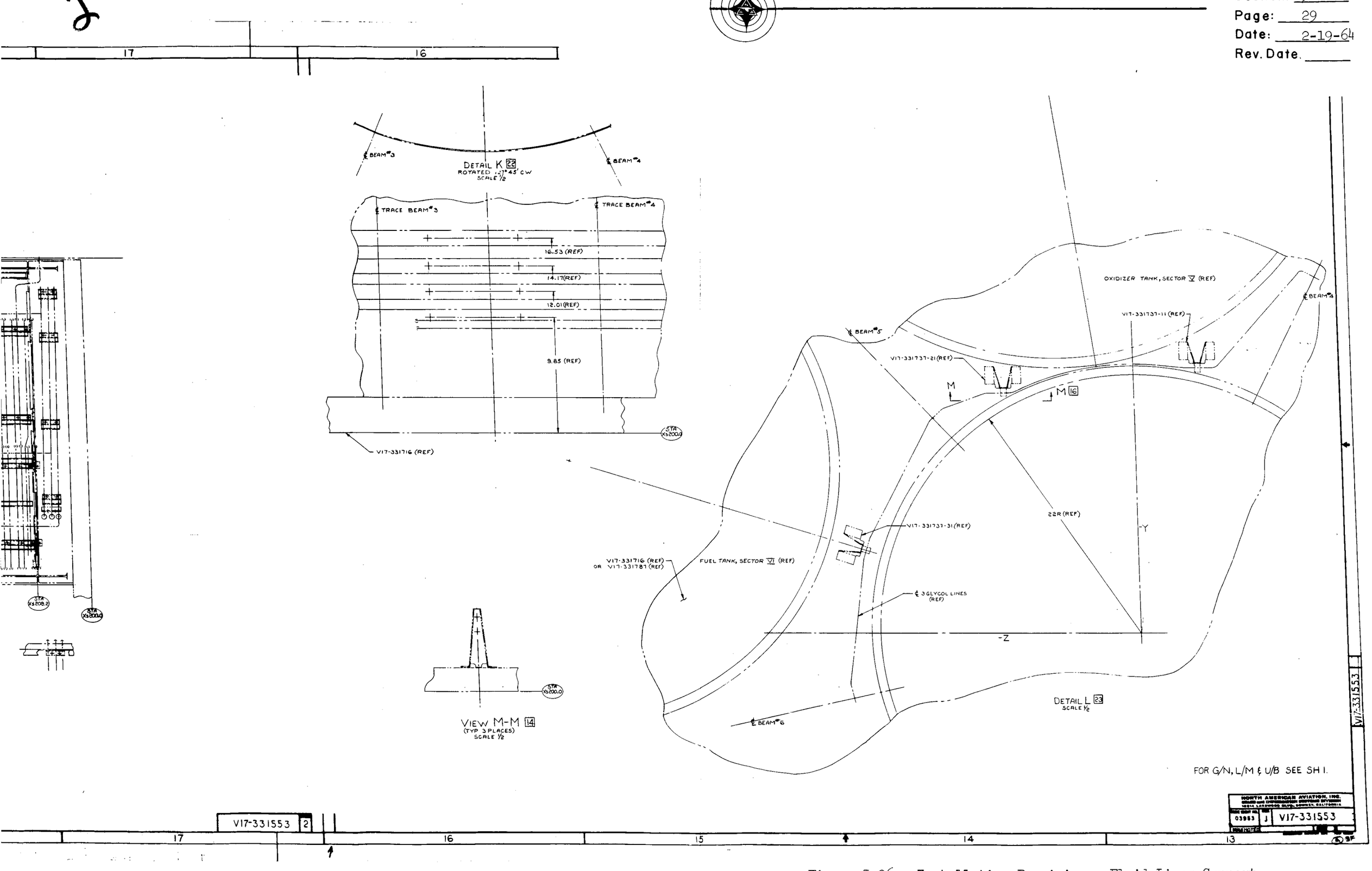
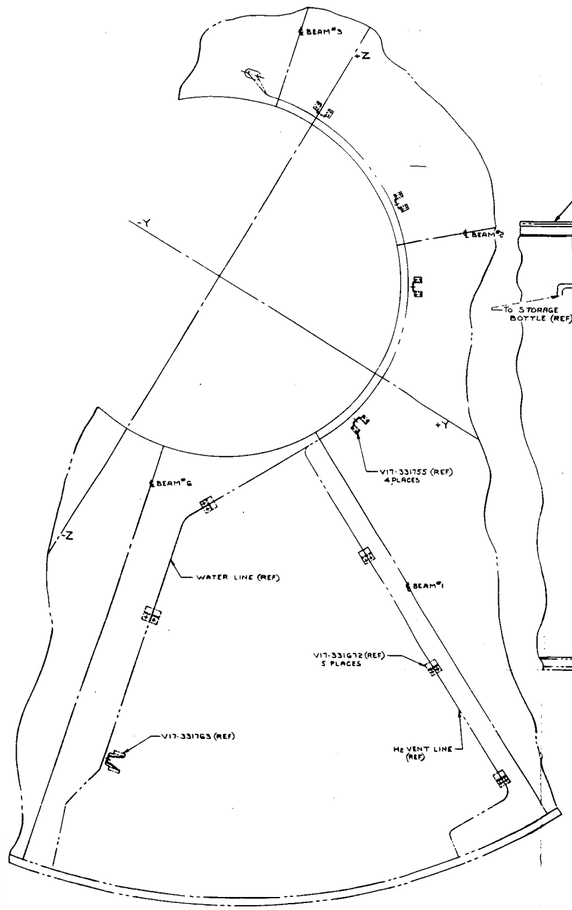
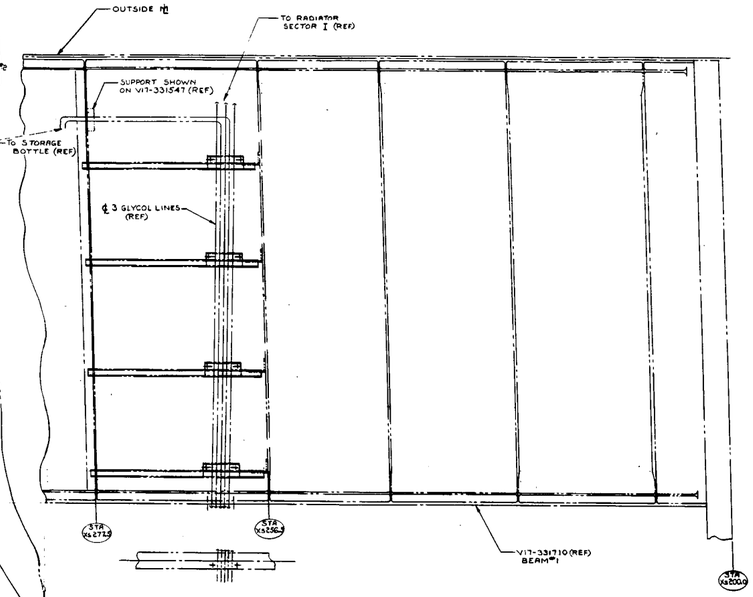


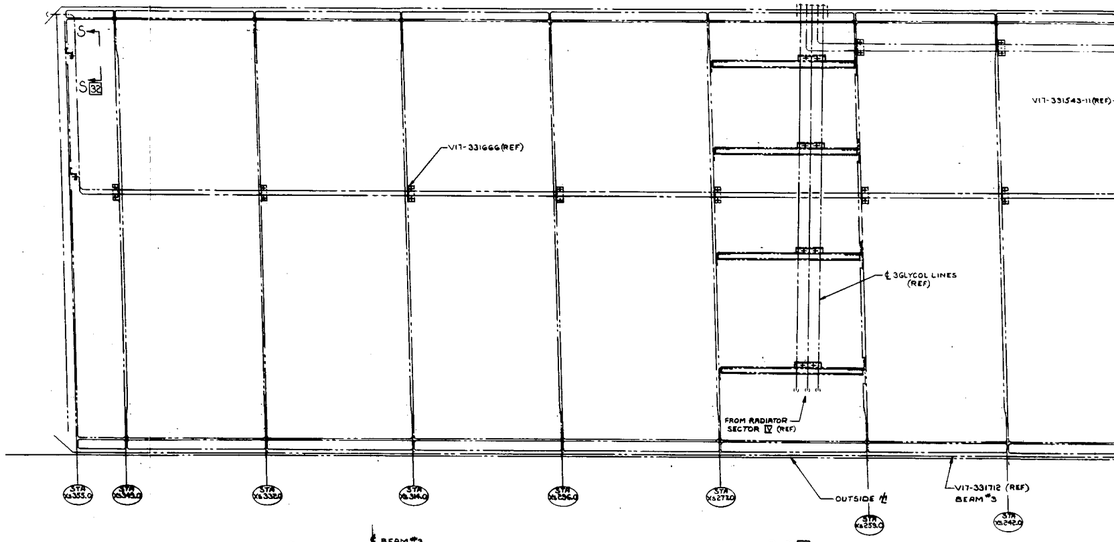
Figure 5-26. Installation Provisions, Fluid Lines Support, Electrical Power System (V17-331553-2)



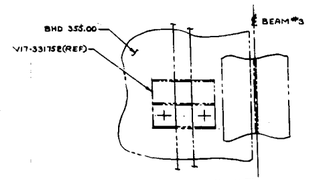
VIEW T-T [7]
ROTATED 180° C.W.
SCALE 1/4
VIEW LOOKING AFT ON BHD 355.00



VIEW D-D [20]
ROTATED 158°45' CW
SCALE 1/4



VIEW B-B [22]
ROTATED 108°45' CW
SCALE 1/4



VIEW S-S [32]
SCALE 1/2
(TYP 2 PLACES)

SERVICE MODULE



VI1-331553 [1]

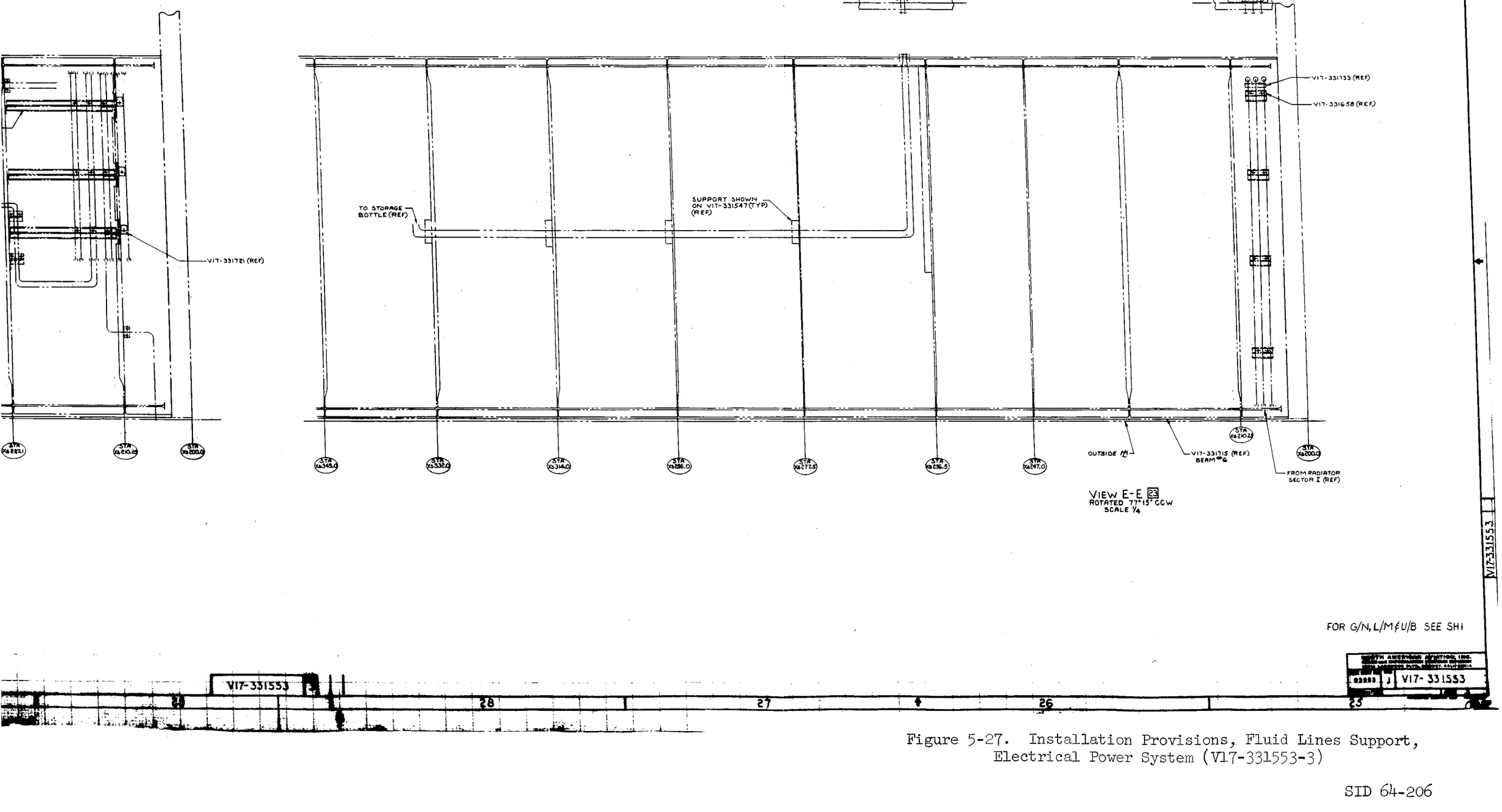


Figure 5-27. Installation Provisions, Fluid Lines Support, Electrical Power System (V17-331553-3)

6.0 THERMAL CONTROL STRUCTURES

6.1 Aft Heat Shield

6.1.1 There are two means of thermal control of the S/M structures: a) the aft heat shield below the aft bulkhead at Station XS 200; and b) the service module insulation. (Note: Insulation of the RCS heat shields is mentioned in 5.3.4.)

6.1.2 The aft heat shield is fabricated from nickel, Fiberglas, quartz fiber, and aluminized Mylar. Nickel 0.005 to 0.15-inch thick forms the outer shell. Drawing V17-331944 (Figure 6-1) depicts the outer shell assembly (typical) for Sectors Three, Four and Five. Fiberglas which varies in thickness between 0.03 and 0.06 inch makes up the inner shell as illustrated for Sectors Three, Four, and Five in drawing V17-331700 (Figure 6-2). Quartz fiber 1.0-inch thick is used as an interlining between the outer and inner shells, while aluminized Mylar about 0.25-inch thick on the inboard side of the inner shell supplies the last layer of the aft heat shield. Differential pressure between the S/M and the adapter during prelaunch GN_2 purge and boost blow-down is relieved by five valves placed in the outer shell of the aft heat shield. Drawing V17-331689 (Figures 6-3 through 6-4) shows installation details for the heat shield.

6.1.3 The aft heat shield and the flexible boot protect the main SPS tanks, propellant distribution systems, and electrical wiring from SPS engine heating.

6.1.4 Criteria which influenced the configuration of the aft heat shield were these: a) provision of sufficient clearance space for fuel lines, valves, tanks, engine gimbal, and high-gain antenna below the aft bulkhead; b) provision of an interface between the engine and the fuel tanks; c) choice of materials for weight and the best thermal protection.

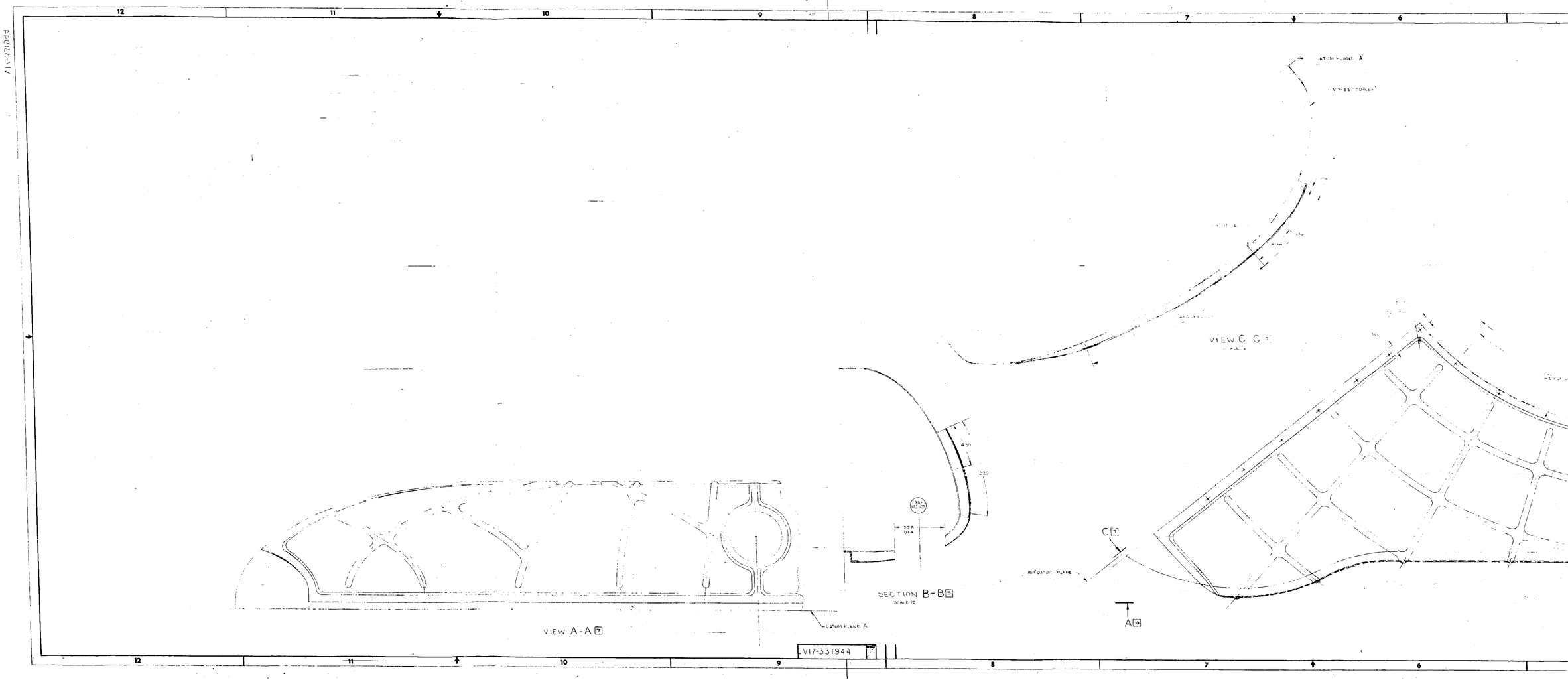
6.1.5 On either the normal launch mission or the normal launch abort mission the aft heat shield will fully protect the SPS tanks, valving, and distribution lines from engine radiation temperatures in excess of 2000 F.

6.1.6 Other and more technical criteria which have been used to set the design of the aft heat shield are found in the ARM-6.

6.1.7 No tests are planned for the aft heat shield, hence there are no test requirements.

6.2 Service Module Insulation

6.2.1 Crinkled, aluminized Mylar is the insulation material used in all sectors of the service module and in the space between the service module and the command module. One-half inch of space


DATUM PLANE A
VIEW C C
SECTION B-B
VIEW A-A
DATUM PLANE A
C
A
CV17-331944

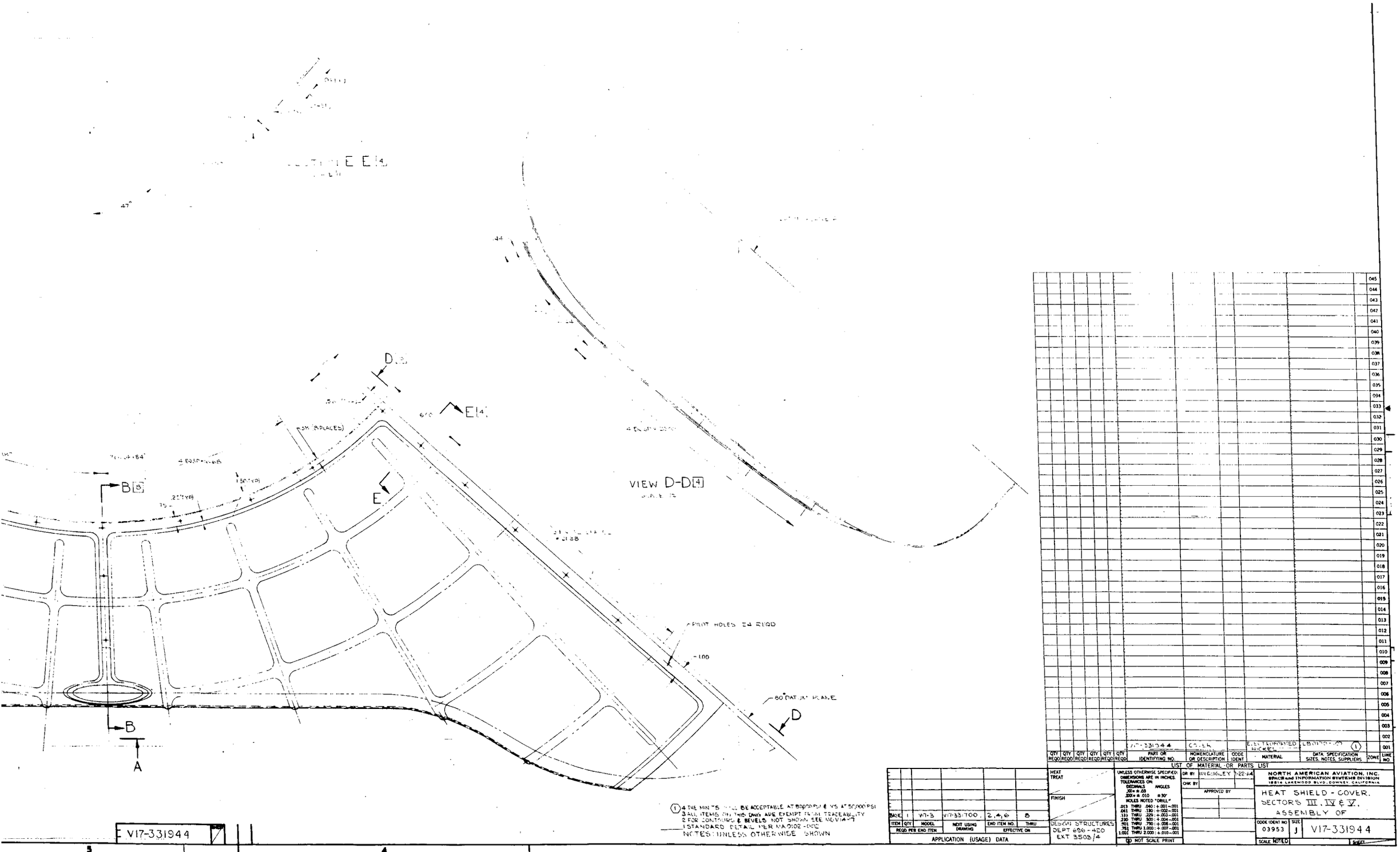
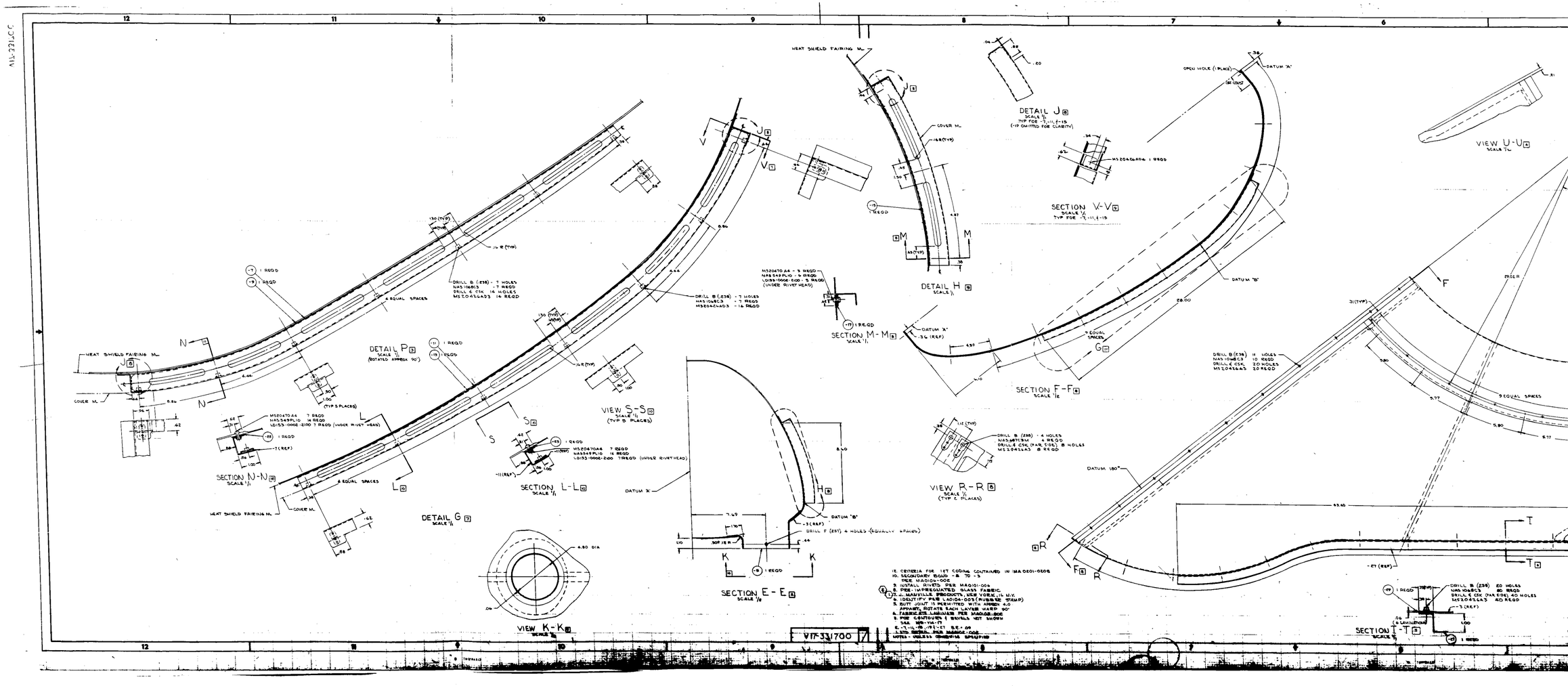
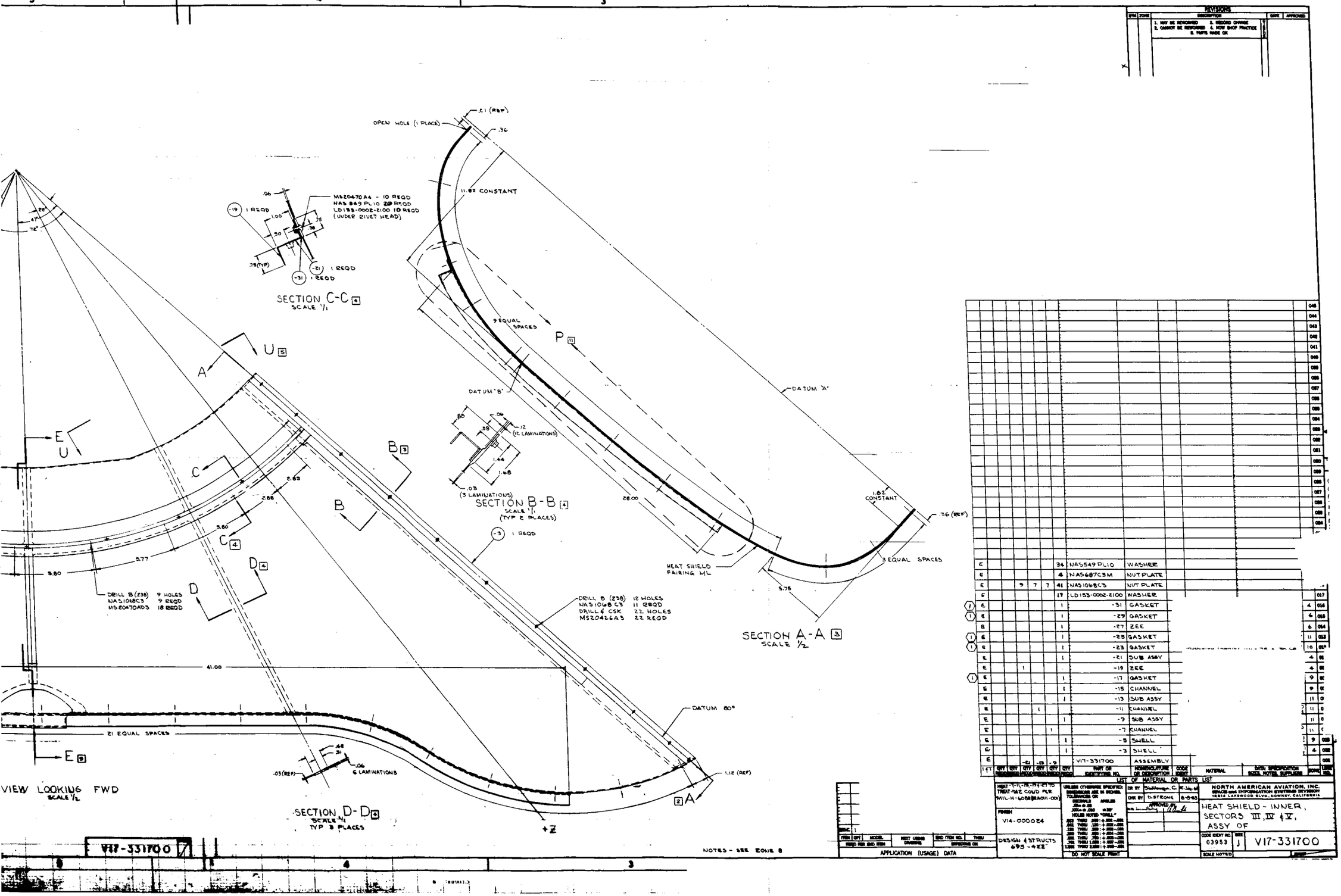


Figure 6-1. Outer Shell Assembly, Aft Heat Shield, Sectors Three, Four, and Five (V17-331944)


HEAT SHIELD FAIRING ML
COVER ML
DETAIL P
SECTION N-N
DETAIL G
SECTION L-L
VIEW S-S
VIEW K-K
SECTION E-E
DETAIL J
DETAIL H
SECTION M-M
SECTION V-V
SECTION F-F
VIEW R-R
VIEW U-U
SECTION T-T
DATUM "A"
DATUM "B"
DATUM "R"
DATUM 180°
OPEN HOLE (1 PLACE)
9 EQUAL SPACES
8 EQUAL SPACES
VIT-331700



ITEM	QTY	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
E	34	NAS549PL10	WASHER
E	4	NAS687C3M	NUT PLATE
E	41	NAS1068C3	NUT PLATE
F	17	LD153-0002-2100	WASHER
E	1	-31	GASKET
E	1	-29	GASKET
B	1	-27	ZEE
E	1	-25	GASKET
E	1	-23	GASKET
E	1	-21	SUB ASSY
E	1	-19	ZEE
E	1	-17	GASKET
E	1	-15	CHANNEL
E	1	-13	SUB ASSY
E	1	-11	CHANNEL
E	1	-9	SUB ASSY
E	1	-7	CHANNEL
E	1	-5	SHELL
E	1	-3	SHELL
E	1	V17-331700	ASSEMBLY

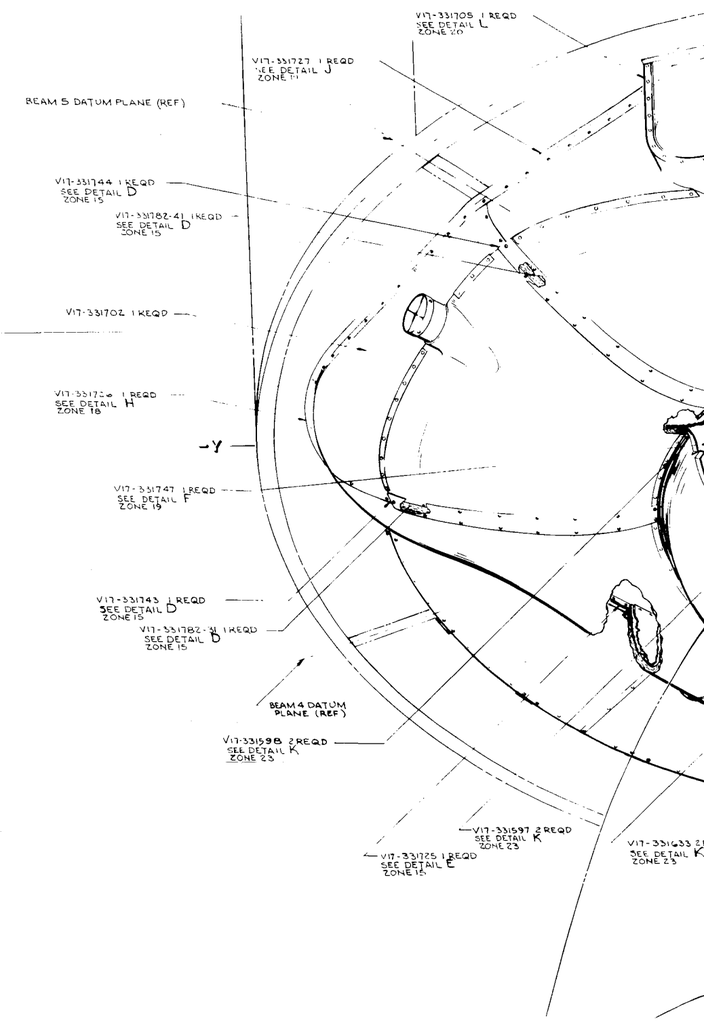
LIST OF MATERIAL OR PARTS LIST

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

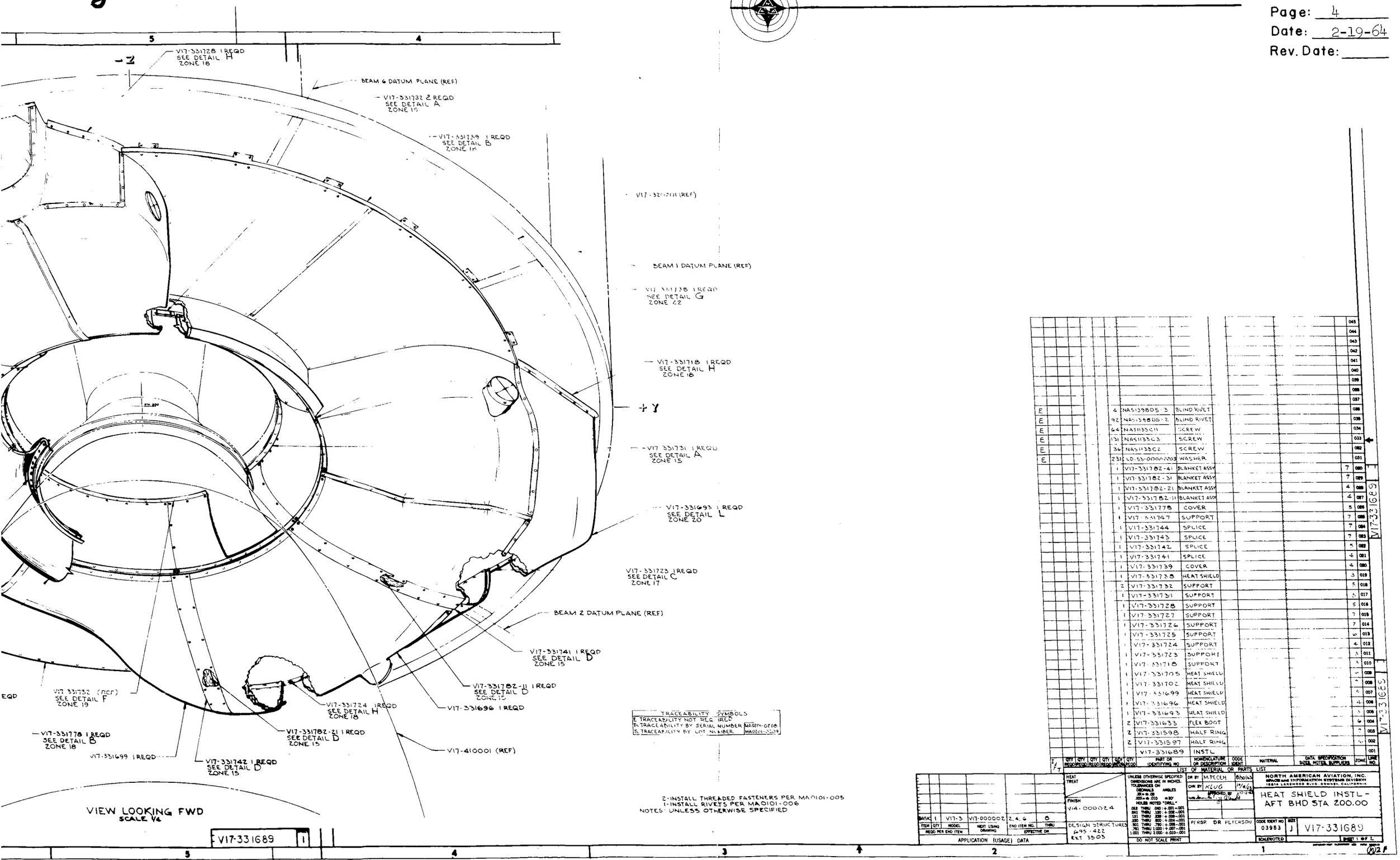
HEAT SHIELD - INNER, SECTORS III, IV & V, ASSY OF

CODE IDENT NO. 03953 | SIZE J | V17-331700

Figure 6-2. Inner Shell Assembly, Aft Heat Shield, Sectors Three, Four, and Five (V17-331700)


V17-331705 1 REQD
SEE DETAIL L
ZONE 20
V17-331727 1 REQD
SEE DETAIL J
ZONE 11
BEAM 5 DATUM PLANE (REF)
V17-331744 1 REQD
SEE DETAIL D
ZONE 15
V17-331782-41 1 REQD
SEE DETAIL D
ZONE 15
V17-331702 1 REQD
V17-331720 1 REQD
SEE DETAIL H
ZONE 18
-Y
V17-331747 1 REQD
SEE DETAIL F
ZONE 19
V17-331743 1 REQD
SEE DETAIL D
ZONE 15
V17-331782-31 1 REQD
SEE DETAIL D
ZONE 15
BEAM 4 DATUM
PLANE (REF)
V17-331598 2 REQD
SEE DETAIL K
ZONE 23
V17-331597 2 REQD
SEE DETAIL K
ZONE 23
V17-331725 1 REQD
SEE DETAIL E
ZONE 15
V17-331633 2
SEE DETAIL K
ZONE 23

V17-331689 1



E	4	NAS1398DS-3	BLIND RIVET	
E	92	NAS1398DS-2	BLIND RIVET	
E	64	NAS1155C11	SCREW	
E	131	NAS1133C3	SCREW	
E	36	NAS1133C2	SCREW	
E	231	LD-93-0004-2203	WASHER	
	1	V17-331782-41	BLANKET ASSY	7
	1	V17-331782-31	BLANKET ASSY	7
	1	V17-331782-21	BLANKET ASSY	4
	1	V17-331782-11	BLANKET ASSY	4
	1	V17-331778	COVER	5
	1	V17-331747	SUPPORT	7
	1	V17-331744	SPLICE	7
	1	V17-331743	SPLICE	7
	1	V17-331742	SPLICE	5
	1	V17-331741	SPLICE	4
	1	V17-331739	COVER	4
	1	V17-331738	HEAT SHIELD	3
	2	V17-331732	SUPPORT	5
	1	V17-331731	SUPPORT	3
	1	V17-331728	SUPPORT	5
	1	V17-331727	SUPPORT	7
	1	V17-331726	SUPPORT	7
	1	V17-331725	SUPPORT	6
	1	V17-331724	SUPPORT	4
	1	V17-331723	SUPPORT	3
	1	V17-331718	SUPPORT	3
	1	V17-331705	HEAT SHIELD	5
	1	V17-331702	HEAT SHIELD	7
	1	V17-331699	HEAT SHIELD	5
	1	V17-331696	HEAT SHIELD	4
	1	V17-331693	HEAT SHIELD	3
	2	V17-331633	FLEX BOOT	6
	2	V17-331598	HALF RING	7
	2	V17-331597	HALF RING	4
		V17-331689	INSTL	

QTY REQD/VEH	QTY REQD/VEH	QTY REQD/VEH	QTY REQD/VEH	QTY REQD/VEH	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT	MATERIAL	DATA: SPECIFICATION SIZE, NOTES, SUPPLIERS	ZONE	ITEM NO.

LIST OF MATERIAL OR PARTS LIST

BASIC ITEM	QTY	MODEL	V17-3	V17-000002	2, 4, 6	8
		REQD PER END ITEM		NEXT USING DRAWING	END ITEM NO.	THRU EFFECTIVE ON

APPLICATION (USAGE) DATA

HEAT TREAT
FINISH V14-000002-4
DESIGN STRUCTURES 695-422 EXT 3505

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS ANGLES .XX ± 0.03 .XXX ± 0.010 ± 30' HOLES NOTED "DRILL"
.063 THRU .240 ± .001 — .001
.241 THRU .130 ± .002 — .001
.131 THRU .250 ± .003 — .001
.251 THRU .500 ± .004 — .001
.501 THRU .750 ± .005 — .001
.751 THRU 1.000 ± .007 — .001
1.001 THRU 2.000 ± .010 — .001
DO NOT SCALE PRINT

DR BY M.PECEN 8/30/63
CHK BY KLUG 11/4/63
APPROVED BY 10-24-63
PERSP. DR PETERSON

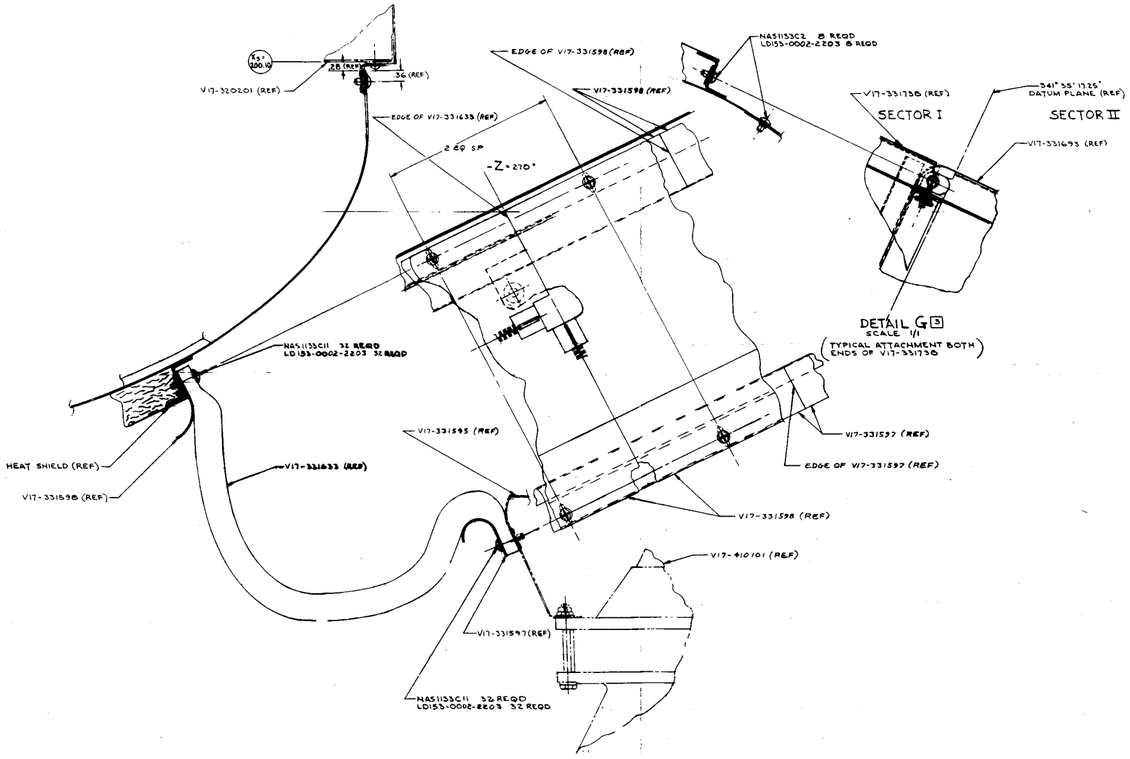
NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD. DOWNEY, CALIFORNIA

HEAT SHIELD INSTL - AFT BHD STA 200.00

CODE IDENT NO. 03983 SIZE J V17-331689
SCALE NOTED SHEET 1 OF 2

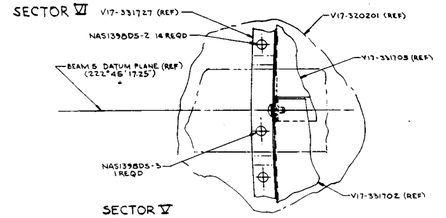
V17-331689

Figure 6-3. Installation of Aft Heat Shield, Station X_S 200 (V17-331689-1)

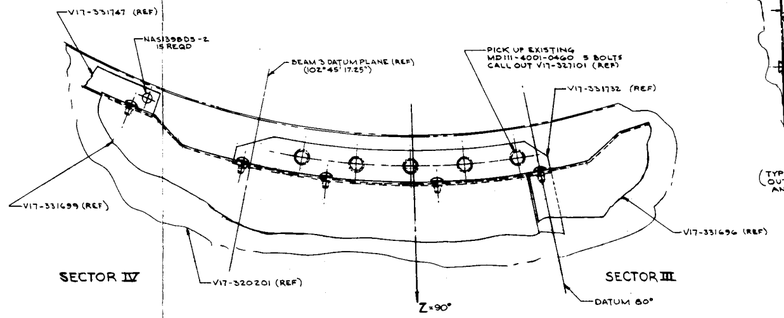


DETAIL G 3
SCALE 1/1
(TYPICAL ATTACHMENT BOTH ENDS OF V17-331750)

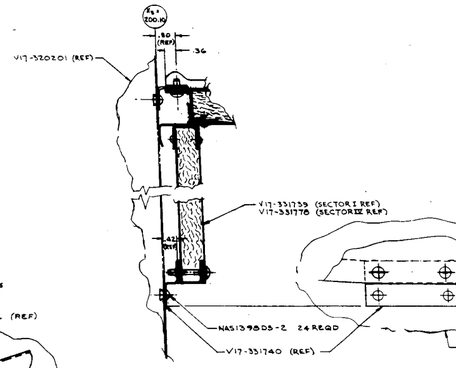
DETAIL K 6 7
SCALE 1/8
(TYPICAL ATTACHMENT FOR FLEXIBLE BOOT TO HEAT SHIELD AND SPS ENGINE)



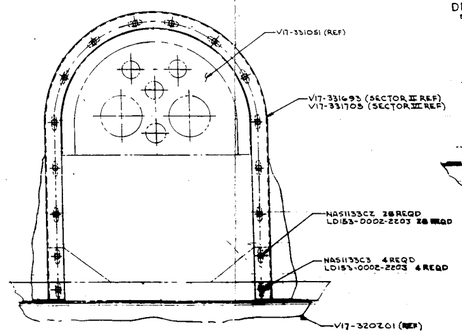
DETAIL J 7
SCALE 1/1



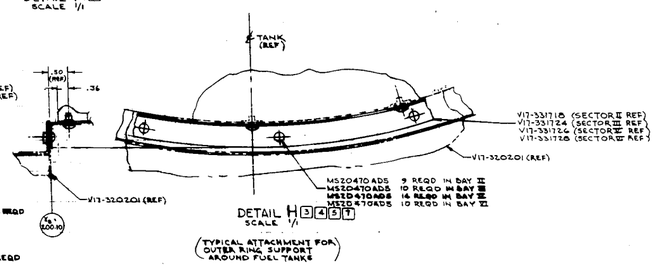
DETAIL F 5
SCALE 1/1



DETAIL B 4 5
SCALE 1/1
(TYPICAL ATTACHMENT FOR OUTER SUPPORT IN SECTOR I AND SECTOR III)



DETAIL L 5 6
SCALE 1/2
(TYPICAL ATTACHMENT FOR [illegible])



DETAIL H 3 4 5 7
SCALE 1/1
(TYPICAL ATTACHMENT FOR OUTER RING SUPPORT AROUND FUEL TANKS)

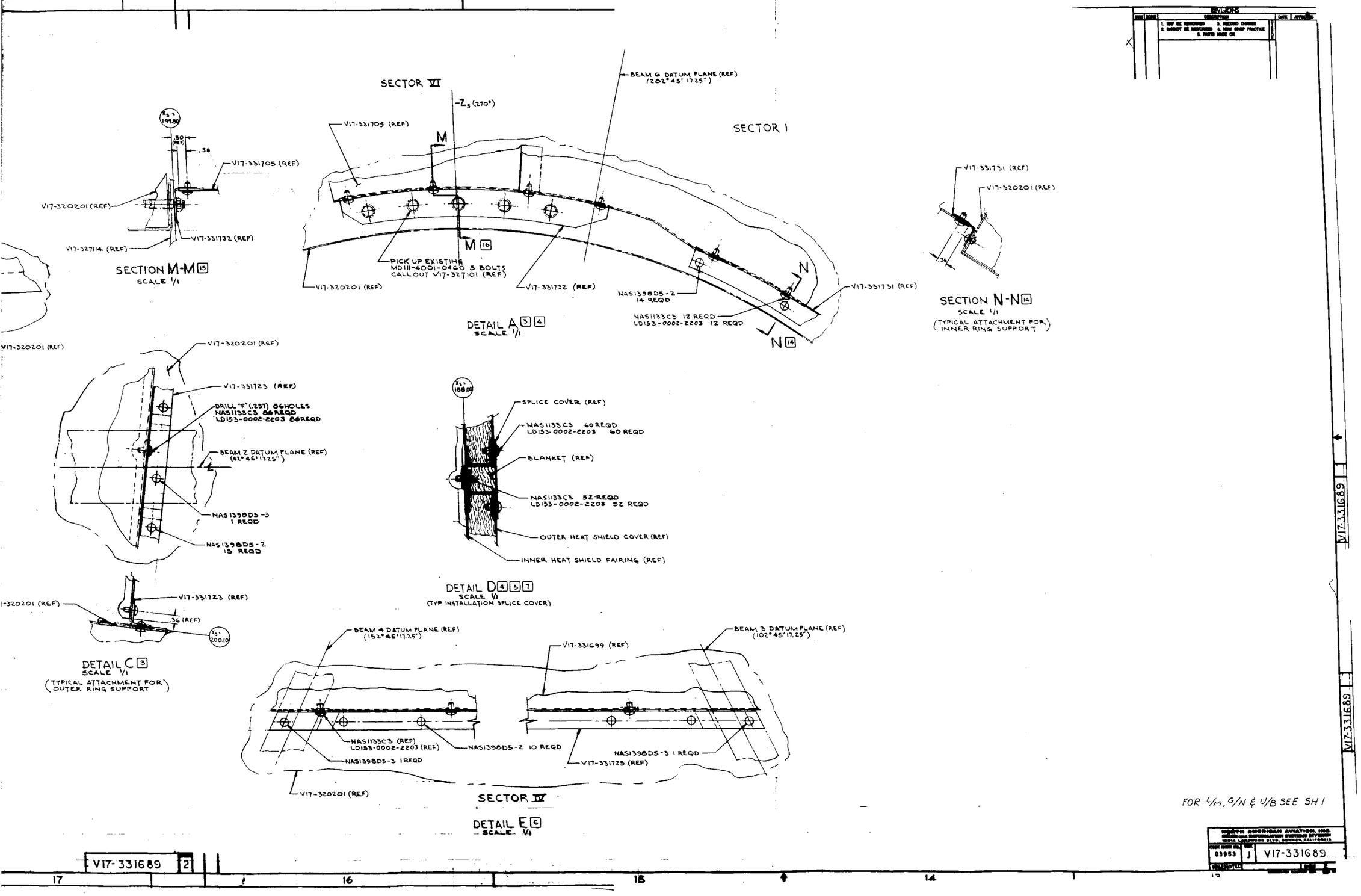


Figure 6-4. Installation of Aft Heat Shield, Station X_S 200 (V17-331689-2)

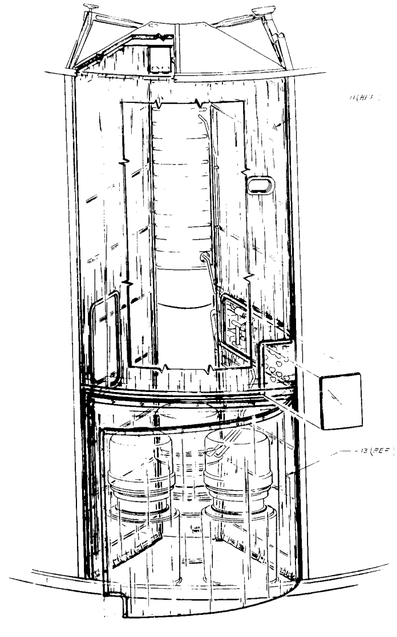
has been allotted for insulation, even though the total thickness of the Mylar layers uncompressed will be only 0.25 inch. Installation accessories are hollow aluminum rods, nylon buttons, cords, and thread; spring clamps; and reflecting pressure-sensitive tape. Drawing V17-331562 (Figures 6-5 through 6-6) shows the perspective of the insulation-installation provisions.

6.2.2 The function of this insulation system is to supplement the aft heat shield in the dissipation of heat from any source and to keep the SPS tanks, propellants, and other equipment at an even, nondestructive, proper, operative temperature. The insulation system also prevents loss of heat in the cold environment of space.

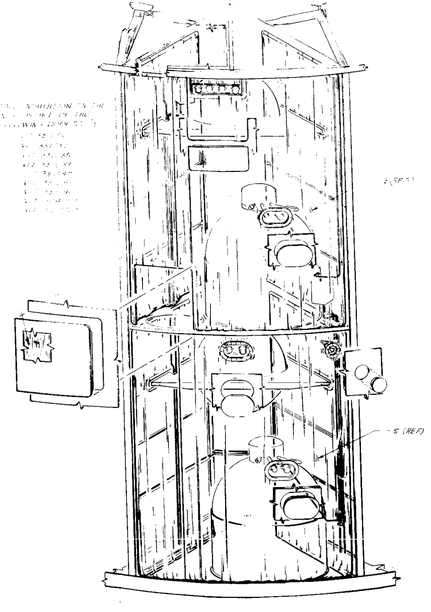
6.2.3 Criteria which governed the choice of aluminized Mylar (NRC-2) as insulation material are these: a) it is the best reported insulation value per pound; b) it has the ability to withstand high compression of large g loads while maintaining initial insulation effectiveness; c) its low bulk density is needed to achieve thermal equilibrium with a minimum loss of cryogenic fluids; d) by its use a high vacuum can be obtained; e) it is easy to apply to complex shapes; f) a minimum effect is obtained from thermal short circuiting.

6.2.4 During the normal launch mission or the normal launch abort mission the thermal insulation system will protect the SPS tanks and internal equipment of the S/M from environmental temperature extremes generated externally. The insulation will maintain the temperature range of 80 through 40 F for the propellant during the mission.

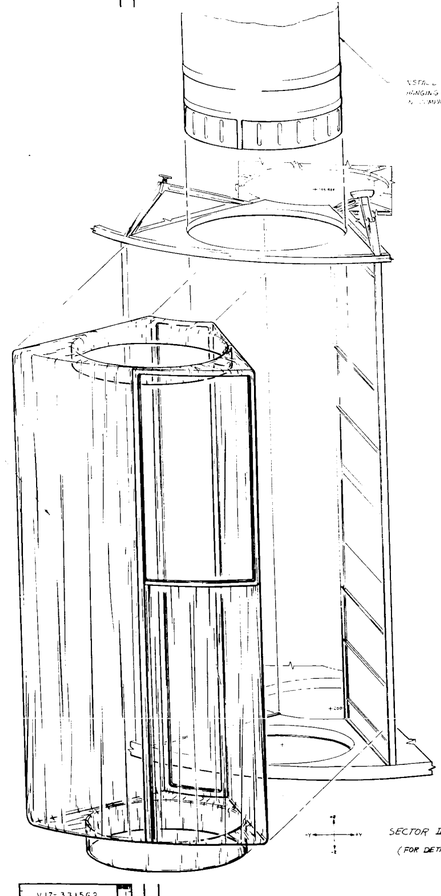
6.2.5 Test requirements for the thermal insulation system are stated in SID 62-109-2, "General Test Plan, Research and Development for Project Apollo Spacecraft, Individual System Test." ATR 306, "Thermodynamic Analysis of the Typically Insulated S/M Propellant Sextant," has not been completed since the test has not been run. However, design work has begun on the thermal simulator - test specimen. Drawing DTT-6600 (Figure 6-7) gives details of the SPS tank-insulation assembly. If additional information is desired, contact can be made with Department 696-210.



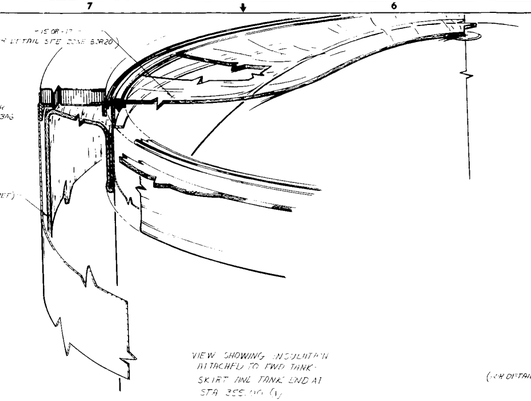
SECTOR IV
(FOR DETAILS SEE ZONE 21)



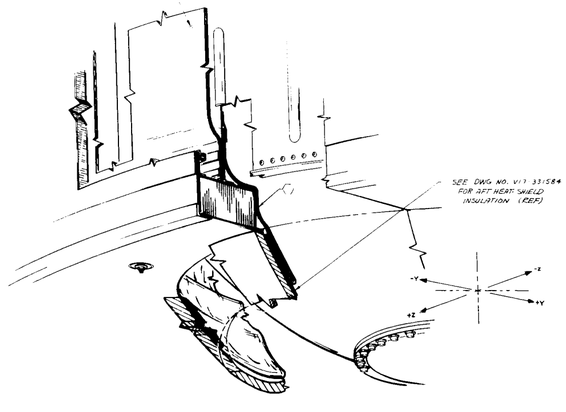
SECTOR I
(FOR DETAILS SEE ZONE 15)



SECTOR III OR VI
(FOR DETAIL SEE ZONE 19)



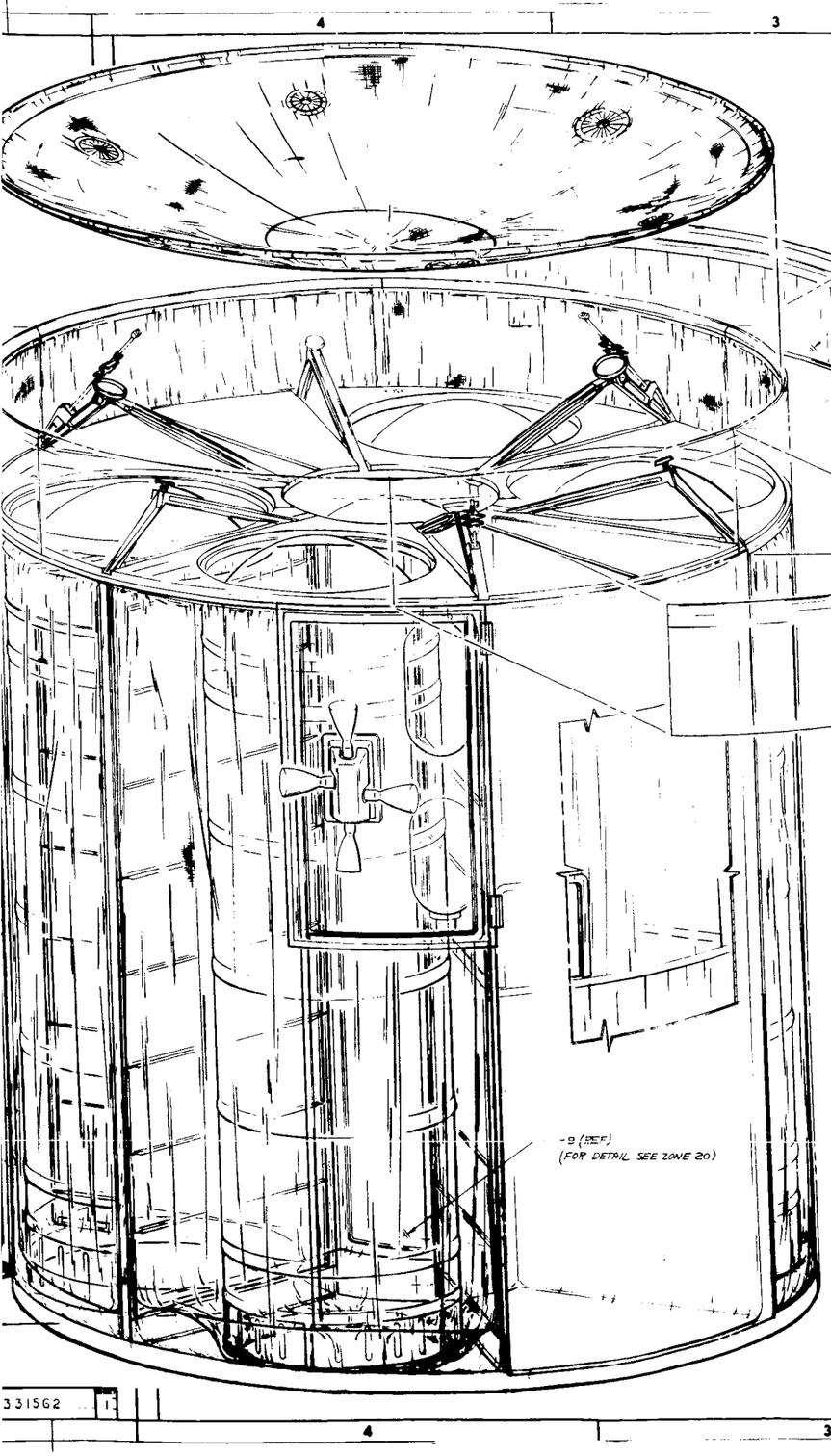
VIEW SHOWING INSULATION ATTACHED TO FWD TANK SKIRT AND TANK END AT STA 355.00 (1)



VIEW SHOWING INSULATION ATTACHED TO AFT TANK SKIRT, INNER AND OUTER SURFACES AT STA 203.00 (1)



V17-331562



REVISIONS

SYM	ZONE	DESCRIPTION	DATE	APPROVED
		1. MAY BE REWORKED 3. RECYCLED CHANGE 2. CANNOT BE REWORKED 4. NOW SHOP PRACTICE 5. PARTS MADE OK		

2. IDENTIFY PER LAC DWG XXX.

① ALL MATERIAL, FABRICATION, AND INSTALLATION OF THE INSULATION ASSYS TO BE IN ACCORDANCE WITH MA-0311-1001 ENTITLED: FABRICATION & INSTALLATION OF A MULTI-LAYER ALUMINIZED MYLAR INSULATION BLANKET FOR USE IN THE APOLLO SERVICE MODULE.

GEN NOTES: UNLESS OTHERWISE NOTED.

LIST OF MATERIAL OR PARTS LIST

QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT	MATERIAL	DATA SPECIFICATION SIZES, NOTES, SUPPLIERS	ZONE	LINE NO.
			1		-19	COVER, FULL			①	22	010
			2		-17	COVER, SC				5	009
			2		-15	COVER, FUEL				20	008
			1		-13	BAG, LOWER				21	007
			1		-11	BAG, UPPER				21	006
			2		-9	BAG, FUEL				20	005
			2		-7	BAG, SC				7	004
			1		-5	BAG, LOWER				15	003
			1		-3	BAG, UPPER				15	002
			1		V17-331542	INSTALL CF					001

				HEAT TREAT	
				FINISH	
				DESIGN: STRUCT DEPT 495-422	
ASSY	V	V17-3	V17-000002		-
ITEM	QTY	MODEL	NEXT USING DRAWING	END ITEM NO	THRU
REQD PER END ITEM			EFFECTIVE ON		
APPLICATION (USAGE) DATA					

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ON: DECIMALS .XX ± .03, .XXX ± .010, ±30' ANGLES. HOLES NOTED "DRILL": .013 THRU .060 +.001 -.001; .061 THRU .130 +.002 -.001; .131 THRU .229 +.003 -.001; .230 THRU .500 +.004 -.001; .501 THRU .750 +.005 -.001; .751 THRU 1.000 +.007 -.001; 1.001 THRU 2.000 +.010 -.001. DO NOT SCALE PRINT.

DR BY LOGSDON 5-MAY-3
CHK BY
APPROVED BY
PERSP. J. BERGMAN

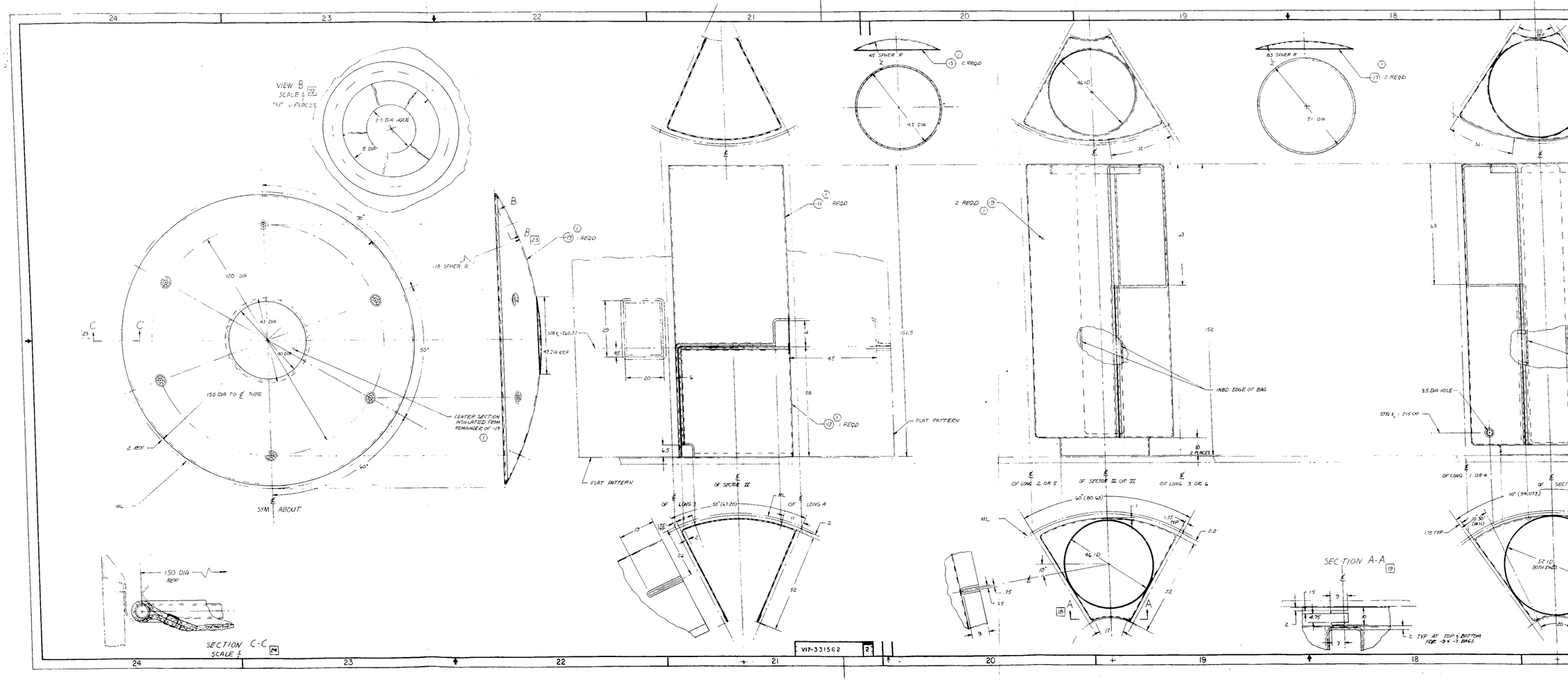
NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

INSULATION INSTALLATION PROVISIONS FOR

CODE IDENT NO 03953 | SIZE J | V17-331562
SCALE .12 | SHEET 1 OF 2

331562 | 12

Figure 6-5. Insulation Installation Provisions, Service Module (V17-331562-1)


VIEW B
SCALE 1
TYP 4 PLACES
2.5 DIA HOLE
5 DIA
120 DIA
43 DIA
30 DIA
150 DIA TO ℄ TUBE
70°
50°
40°
2 REF
ML
SYM ABOUT
B
B
1 REQD
158 SPHER R
STA X = 140.37
43 DIA REF
CENTER SECTION INSULATED FROM REMAINDER OF -17
45° SPHER R
2 REQD
45 DIA
46.10
83 SPHER R
51 DIA
20 REF
32
1 REQD
2 REQD
151.5
45
20
6
58
FLAT PATTERN
3
152
INBD EDGE OF BAG
10
2 PLACES
63
3.5 DIA HOLE
STA X = 215.00
OF LONG 2 OR 5
OF SECTOR III OR IV
OF LONG 3 OR 6
OF LONG 1 OR 4
OF SECTOR II
OF LONG 3
50° (67.20)
ML OF LONG 4
70° (94.073)
60° (80.63)
1.75 TYP
2.0
10.30 (14.11)
52.10 BOTH ENDS
SECTION A-A
SECTION C-C
SCALE 1
150 DIA REF
.75 TYP
4.75
7
2 TYP AT TOP & BOTTOM FOR -9 & -13 BAGS
V17-331562

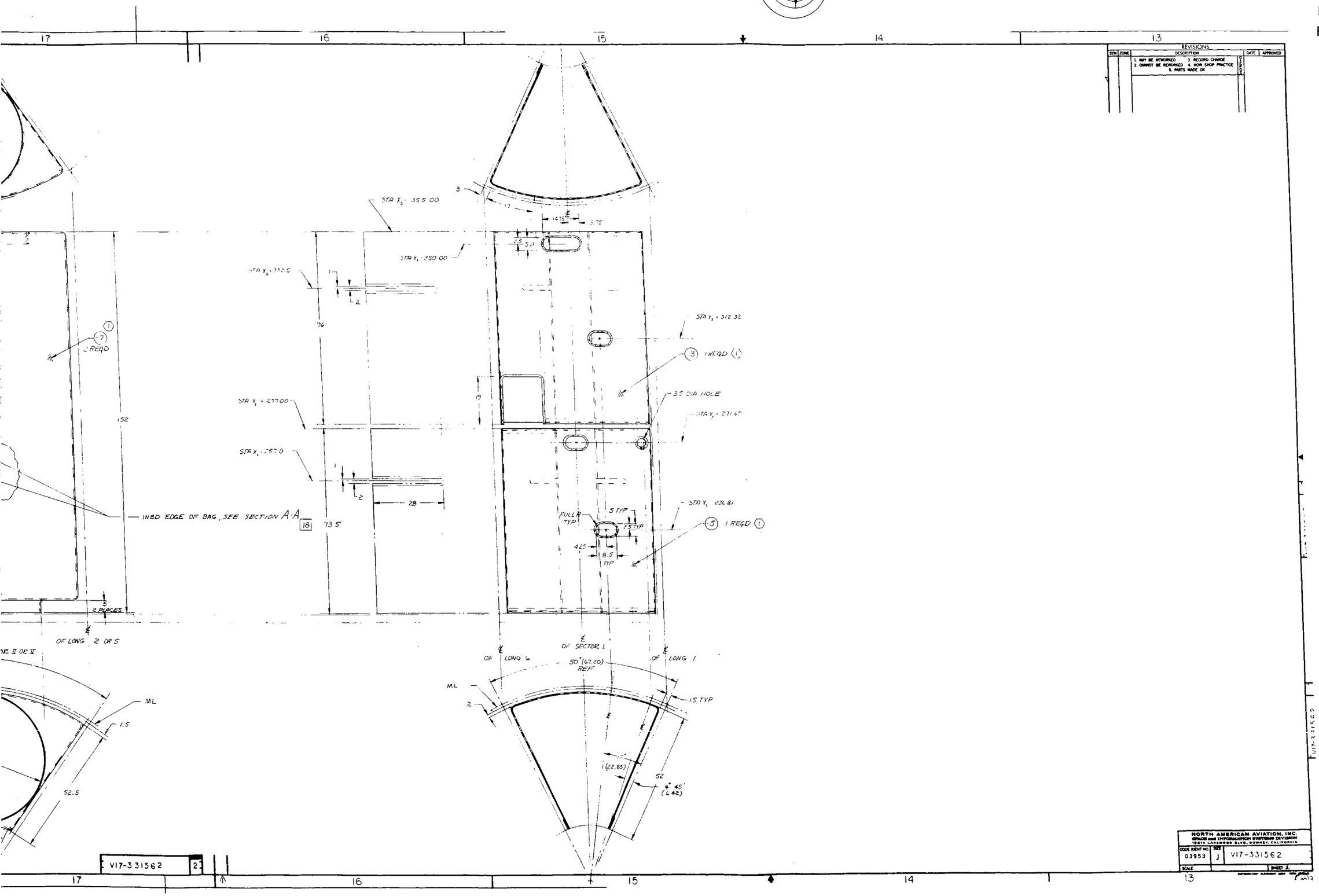
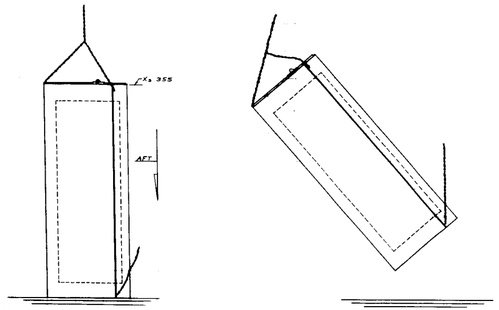
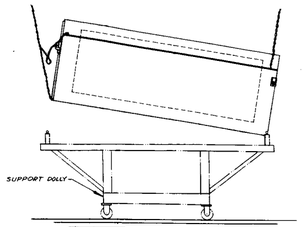


Figure 6-6. Insulation Installation Provisions, Service Module (V17-331562-2)

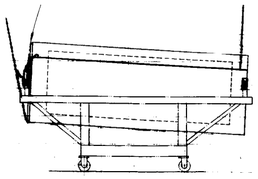


(1) POSITION OF SIMULATOR AFTER ASSEMBLY. SPS TANK MUST CONTAIN NO FLUID. OVERHEAD CRANE OPERATOR MUST MAKE CERTAIN THAT ALL FOUR (4) CHAINS ON FWD BULKHEAD (Xs 355) ARE IN TENSION BEFORE PICKING UP THERMAL SIMULATOR.

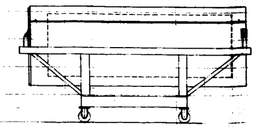
(2) TWO (2) CHAINS ON AFT END CONE INTO PLAY AS CRANE OPERATOR BEGINS TO SWING SIMULATOR INTO A HORIZONTAL POSITION.



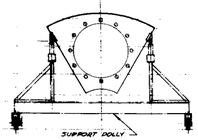
(3) SIMULATOR APPROACHING A HORIZONTAL POSITION.



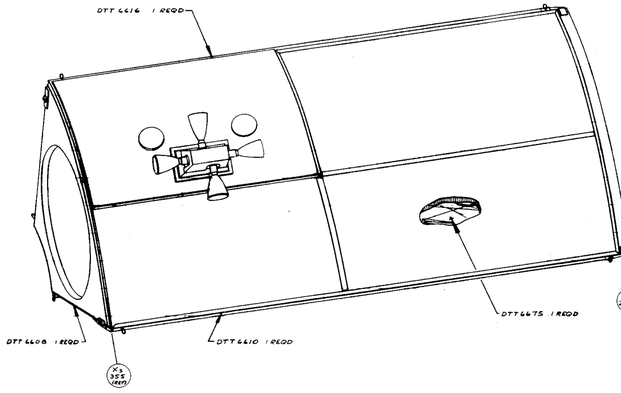
(4) AFT END OF SIMULATOR IS EASED INSIDE DOLLY. AFT SIMULATOR "FITTINGS" ARE BOLTED (DOCK-TYPE BOLTS) TO DOLLY ROD END BEARINGS.



(5) FORWARD END OF SIMULATOR IS EASED DOWN. FWD SIMULATOR FITTINGS ARE BOLTED (DOCK-TYPE BOLTS) TO DOLLY ROD END BEARINGS.
TESTS MAY NOW BE CONDUCTED.



CAUTION:
FLUID MUST BE REMOVED FROM SPS TANK EVERY TIME SIMULATOR HAS TO BE HOISTED AND/OR TRANSPORTED



DTT6600

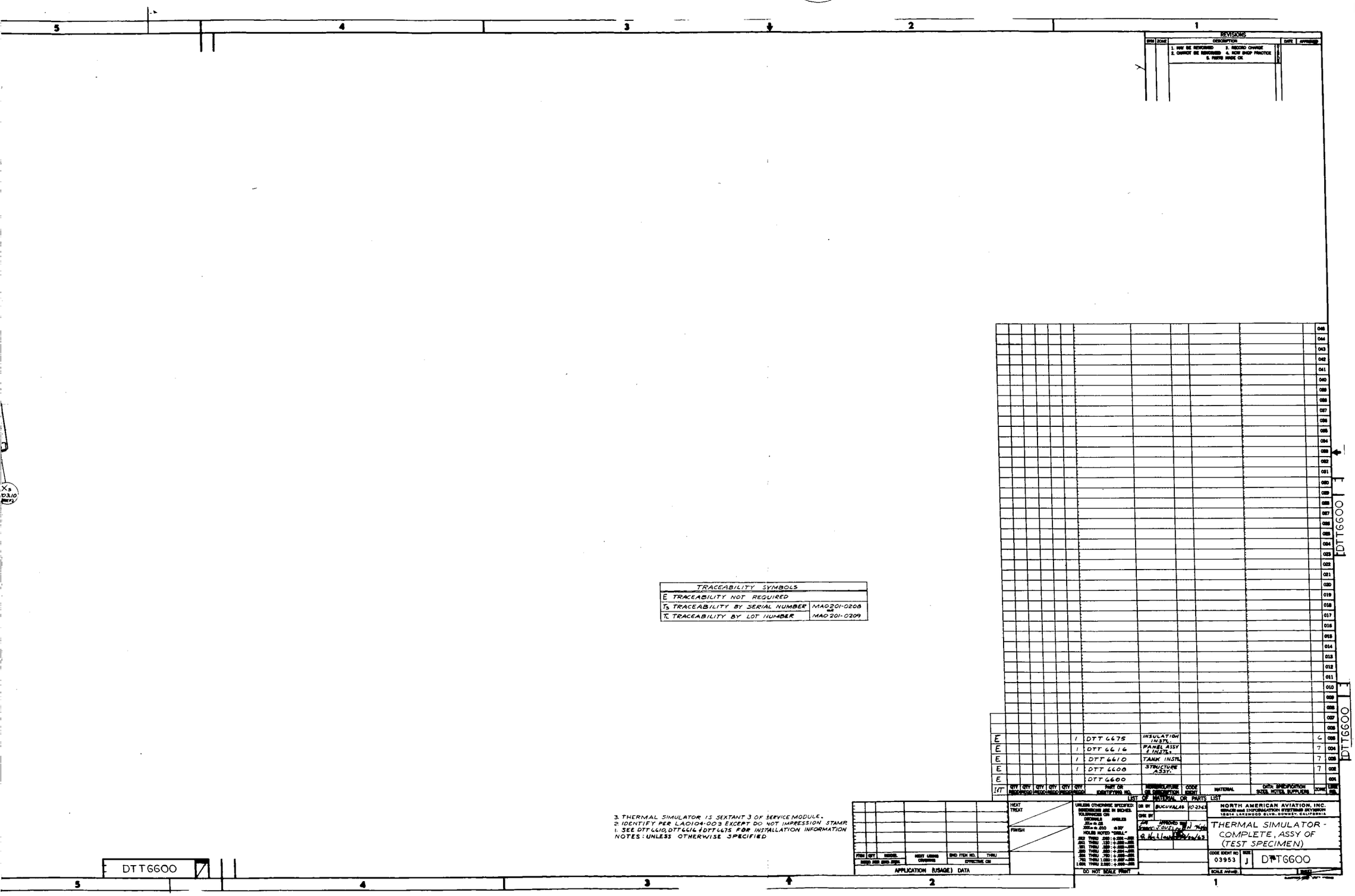


Figure 6-7. Complete Assembly of Thermal Simulator for Specimen Test (DTT-6600)

7.0 SIGNIFICANT INTERFACES

7.1 General

7.1.1 By the term "interface" is meant the common boundary between two or more systems or subsystems. At their points of contact, matching or accommodation must be properly achieved to assure compatibility and successful functioning.

7.1.2 Significant interfaces are divided into two categories: a) those which are external, affecting structures; b) those which are internal, affecting such things as mechanics, hydraulics, pyrotechnics, and things electrical.

7.1.3 Some of the external interfaces are in the study stage. As the studies crystallize into designs, the resultant drawings will be added to later editions of this manual.

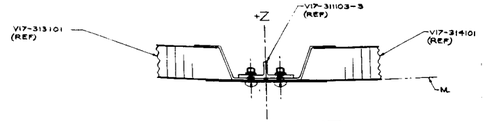
7.1.4 All of the systems-mounting provisions are really interfaces. However, these provisions are separately treated under heading 5.0.

7.2 External Interfaces

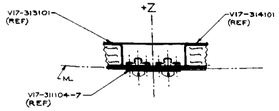
7.2.1 The fairing, an important part of the S/C is one of the chief aerodynamic interfaces between the S/M and the C/M. It is made of six equally sized panels fabricated from bonded aluminum-honeycomb sandwich one-inch thick. Installation drawing V17-310001 (Figures 7-1 through 7-2) and panel assembly drawing V17-311001 (Figure 7-3) depict the fairing interface. The function of the fairing is twofold: a) to shield from atmospheric pressure certain equipment essential to the smooth functioning of the S/M and C/M; b) to prevent rapid evacuation of air from the S/M interior.

7.2.2 The C/M to S/M umbilical with its own fairing is the second vital interface. This fairing is located in Sector One on the outer shell of the S/M - C/M fairing. Drawing V17-331771 (Figure 7-4) shows configuration details of the fairing. Drawing V17-331913 (Figure 7-5) depicts these details for the fly away umbilical. One criterion by which an external structure was added to the otherwise smooth surface of the S/M was the imperative necessity of finding a route for the umbilical - hard lines and electrical wiring - such that it would not penetrate the ablative material of the C/M.

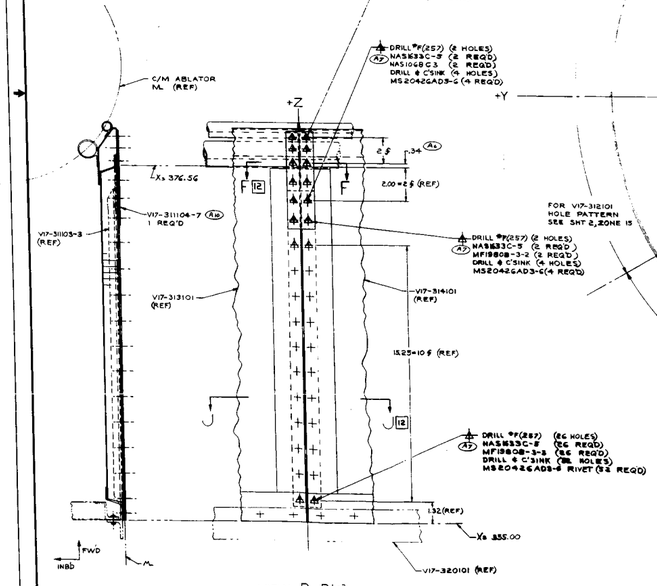
7.2.3 A third significant interface exists between the S/M and the S-1 adapter. The chief feature is a strap-tension tie which also carries the shaped charges used to separate the S-1 adapter panels from the S/C. See drawing V18-300005 (Figure 7-6).



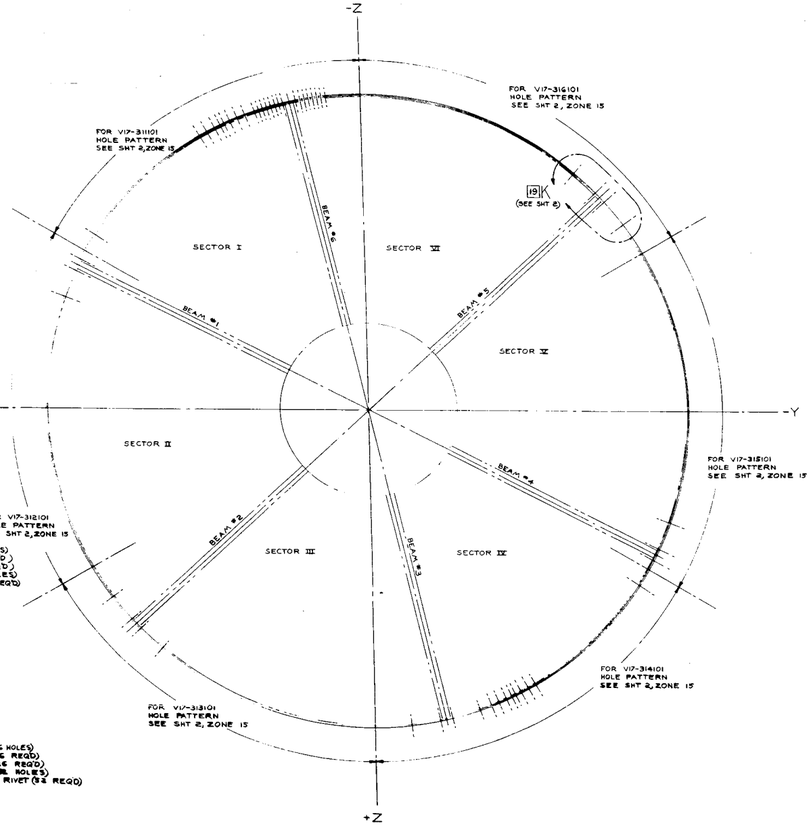
SECTION J-J [12]
SCALE +
TYP 6 PLACES



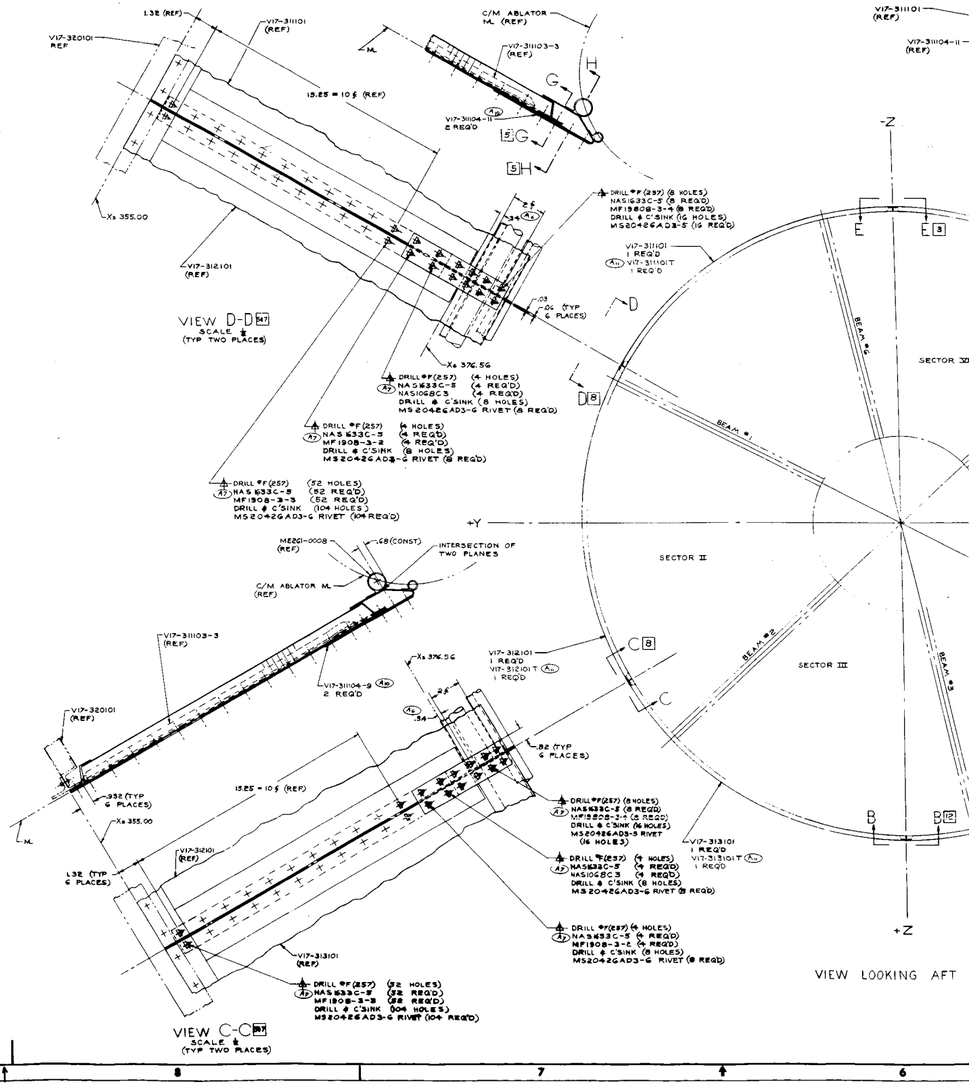
SECTION F-F [12]
SCALE +



VIEW B-B [6]
SCALE +



SECTION A-A [9]

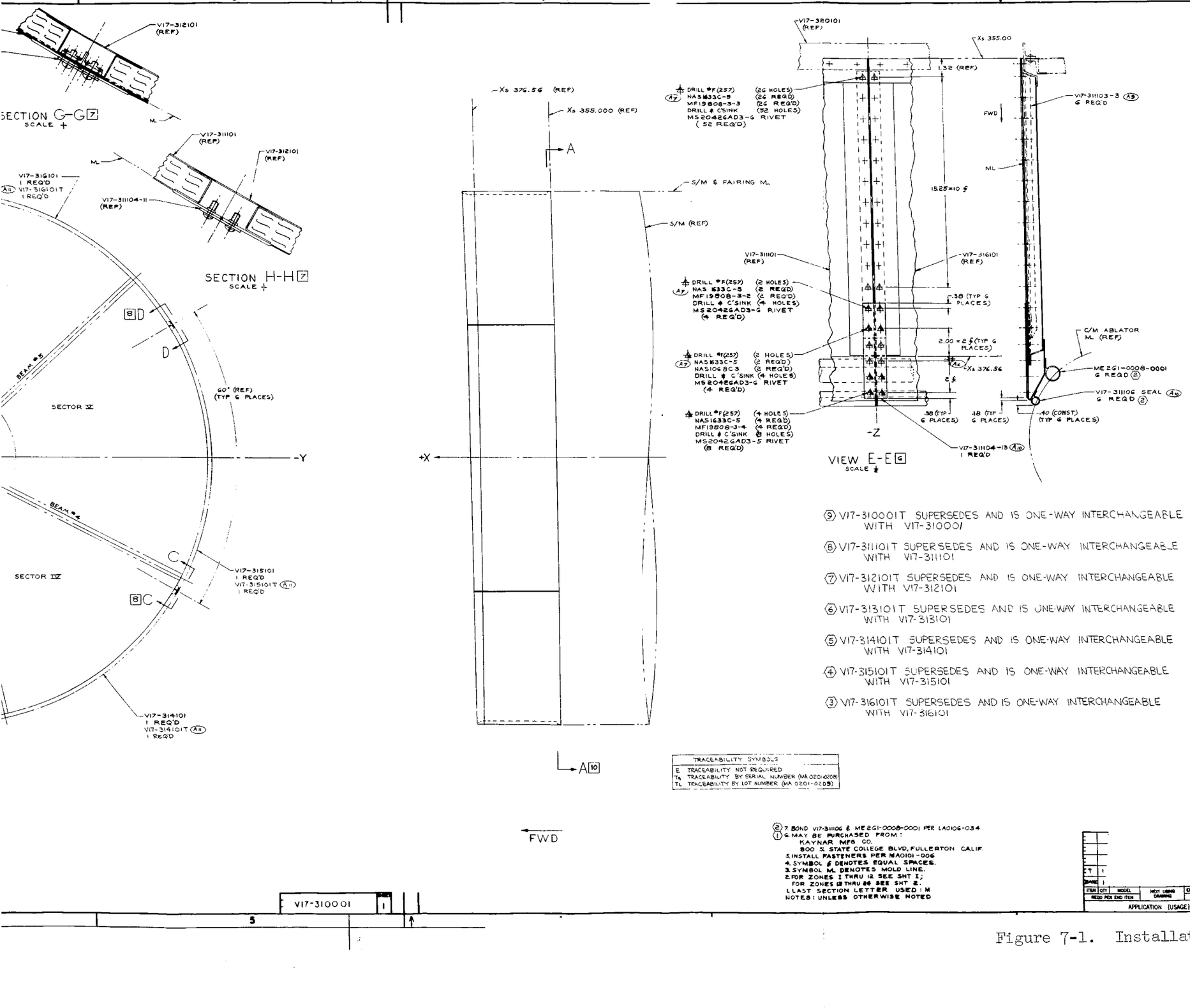


VIEW LOOKING AFT

VIEW C-C [17]
SCALE +
(TYP TWO PLACES)

VIEW D-D [17]
SCALE +
(TYP TWO PLACES)

V17-310001 1



⑨ V17-310001T SUPERSEDES AND IS ONE-WAY INTERCHANGEABLE WITH V17-310001

⑧ V17-311101T SUPERSEDES AND IS ONE-WAY INTERCHANGEABLE WITH V17-311101

⑦ V17-312101T SUPERSEDES AND IS ONE-WAY INTERCHANGEABLE WITH V17-312101

⑥ V17-313101T SUPERSEDES AND IS ONE-WAY INTERCHANGEABLE WITH V17-313101

⑤ V17-314101T SUPERSEDES AND IS ONE-WAY INTERCHANGEABLE WITH V17-314101

④ V17-315101T SUPERSEDES AND IS ONE-WAY INTERCHANGEABLE WITH V17-315101

③ V17-316101T SUPERSEDES AND IS ONE-WAY INTERCHANGEABLE WITH V17-316101

TRACEABILITY SYMBOLS
E TRACEABILITY NOT REQUIRED
Ts TRACEABILITY BY SERIAL NUMBER (MA 0201-0208)
TL TRACEABILITY BY LOT NUMBER (MA 0201-0205)

REVISIONS

SYM	ZONE	DESCRIPTION	DATE	APPROVED
		1. MAY BE REWORKED 3. RECORD CHANGE. 2. CANNOT BE REWORKED 4. NON SHOP PRACTICE 5. PARTS MADE OK		
A	2	1. REMOVED END ITEM #1 FROM U/B	3	E.O. 92830
	2	2. ADDED END ITEM #11 TO U/B	3	
		3. As & A9 SEE SHT II	3	
	3	5. ADDED G/N #7	3	
3,11 F/D		6. .34 WAS .32 (6 PLACES.)	5	
L/M	12	7. NAS1068C3 (18 REQ) WAS MF1031-3-4 (18 REQ'D), NAS1068C4 (24 REQ'D) WAS MF 1031-4 (24 REQ'D), NAS1633C5 (354 REQ'D) WAS NAS1133C5 (358 REQ'D), MF19808-3-3 (346 REQ'D) WAS MF19808-3-4 (24 REQ'D), MF19808-3-4 (24 REQ'D) WAS MF19808-3-3 (4 REQ'D)	5	
L/M	2	8. REMOVED V17-311103-5 (3 REQ'D), V17-311104-3 (1 REQ'D), V17-311104-5 (2 REQ'D), V17-311105-3 (2 REQ'D), V17-311105-5 (1 REQ'D)	1	Stamp Pad 6/11/63
L/M	2	9. V17-311103-3 (6 REQ'D) WAS (3 REQ'D)	1	
L/M	12	10. ADDED V17-311104-7, -9, -11, & -13; V17-311106; ME2G1-0008, REVISED DIMS TO ACCOMMODATE [illegible] PARTS	1	D. WINANS 7-2-63 CN8-16-63
L/M	2	11. ESTABLISHED "T" ASSY, ADDED SERVICE NOTES	3	
	2	12. ADDED "T" REQMTS IN U/B EFFECT ON: ITEMS #7, 8, 9 & 10, V17-3 #2, 4, 6, 7, 8 & 11	3	

													045
													044
													043
													042
													041
													040
													039
													038
													037
													036
3		TL	1			V17-316101 T	SECTOR VI					6	035
4		TL	1			V17-315101 T	SECTOR V					5	034
5		TL	1			V17-314101 T	SECTOR IV					5	033
6		TL	1			V17-313101 T	SECTOR III					7	032
7		TL	1			V17-312101 T	SECTOR II					7	031
8		TL	1			V17-311101 T	SECTOR I					7	030
		E	48	E	48	MF19808-4-3	ANCHOR NUT			⑪			029
		E	24	E	24	MF19808-4-2	ANCHOR NUT			⑪			028
		E	24	E	24	MF19808-3-4	ANCHOR NUT			④			027
		E	346	E	346	MF19808-3-3	ANCHOR NUT			⑪			026
		E	12	E	12	MF19808-3-2	ANCHOR NUT			⑪			025
		E	24	E	24	NAS1068C4	ANCHOR NUT			⑪			024
		E	12	E	12	NAS1068C3	ANCHOR NUT			⑪			023
													022
		E	394	E	394	NAS1633C-5	SCREW						021
		E	96	E	96	NAS1134C-7	SCREW						020
													019
													018
													017
		E	6	E	6	ME2G1-0008-0001	SEAL					2	016
													015
				E	1	V17-316101	SECTOR VI					6	013
				E	1	V17-315101	SECTOR V					5	012
				E	1	V17-314101	SECTOR IV					5	011
				E	1	V17-313101	SECTOR III					7	010
				E	1	V17-312101	SECTOR II					7	009
		E	6	E	6	V17-311106	SEAL					2	008
		E	1	E	1	V17-311104-13	SHEET					3	007
		E	2	E	2	V17-311104-11	SHEET					7	006
		E	2	E	2	V17-311104-9	SHEET					8	005
		E	1	E	1	V17-311104-7	SHEET					12	004
		E	6	E	6	V17-311103-3	SPLICE					2	003
				E	1	V17-311101	SECTOR I					7	002
9		TL	T	E		V17-310001	INSTALLATION						001
QTY PER ASSY	QTY PER SUBASSY	QTY PER NEXT HIGHER ASSY	QTY REQD	QTY PER END ITEM		PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT	MATERIAL	DATA: SPECIFICATION SIZES, NOTES, SUPPLIERS	ZONE	LINE NO.	

T & T LIST OF MATERIAL OR PARTS LIST

HEAT TREAT
FINISH
T 1
GRADE 1
ITEM QTY MODEL
REQD PER END ITEM
NEXT USING DRAWING
END ITEM NO. THRU
EFFECTIVE ON
APPLICATION (USAGE) DATA

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ON: DECIMALS .XX ± .03, .XXX ± .010, HOLES NOTED "DRILL" .033 THRU .040 +.003 -.004, .061 THRU .130 +.005 -.005, .133 THRU .257 +.006 -.005, .290 THRU .500 +.006 -.005, .501 THRU .750 +.008 -.005, .751 THRU 1.000 +.027 -.005, 1.001 THRU 2.000 +.010 -.010, ANGLES ± 30', DO NOT SCALE PRINT

DR BY WINANS 3/6/63
CHK BY
APPROVED BY 4/1/63

NORTH AMERICAN AVIATION, INC. SPACE and INFORMATION SYSTEMS DIVISION 12214 LAKEWOOD BLVD. DOWNEY, CALIFORNIA

FAIRING INSTALLATION-SERVICE MODULE TO COMMAND MODULE

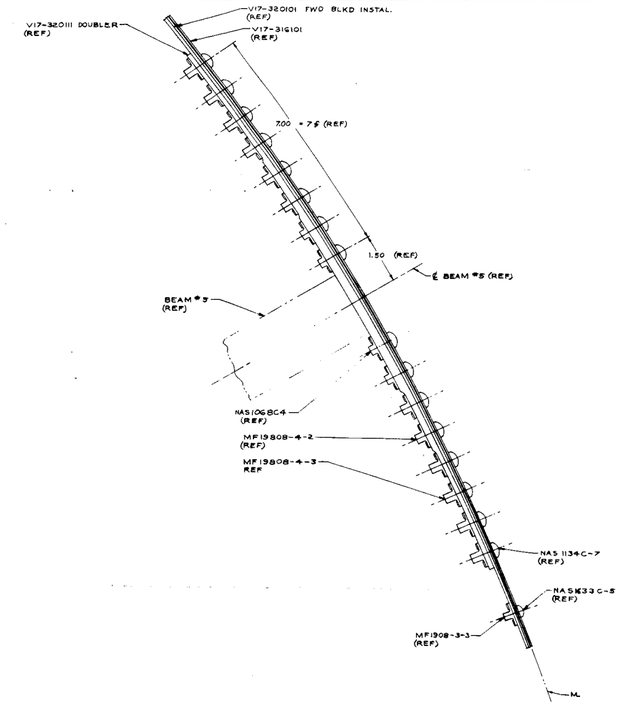
CODE IDENT NO. 03953 SIZE J V17-310001

SCALE 1 WEIGHT SHEET 1 OF 2

NOTES: UNLESS OTHERWISE NOTED
1. LAST SECTION LETTER USED: M
2. FOR ZONES 1 THRU 12 SEE SHT I; FOR ZONES 13 THRU 24 SEE SHT II.
3. SYMBOL M DENOTES MOLD LINE.
4. SYMBOL $ DENOTES EQUAL SPACES.
5. INSTALL FASTENERS PER MA0101-006
6. MAY BE PURCHASED FROM: KAYNAR MFG CO. 800 S. STATE COLLEGE BLVD, FULLERTON CALIF.
7. BOND V17-311106 & ME2G1-0008-0001 PER LA0106-034

V17-310001 SHEET 1

Figure 7-1. Installation of Fairing (V17-310001-1)



VIEW K [5]
SCALE +

V17-310001 2

24 23 22 21 20 19 18

2

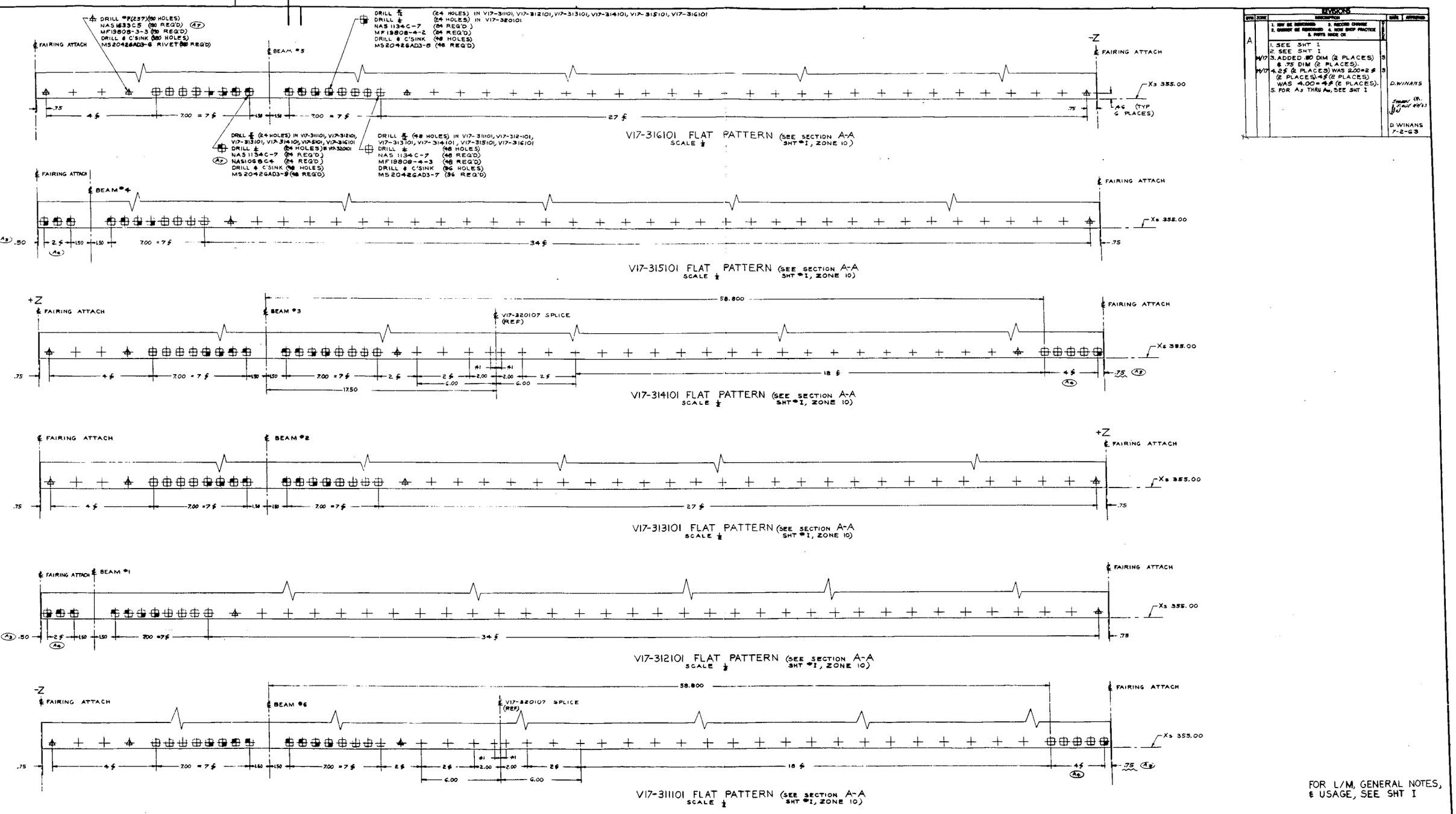
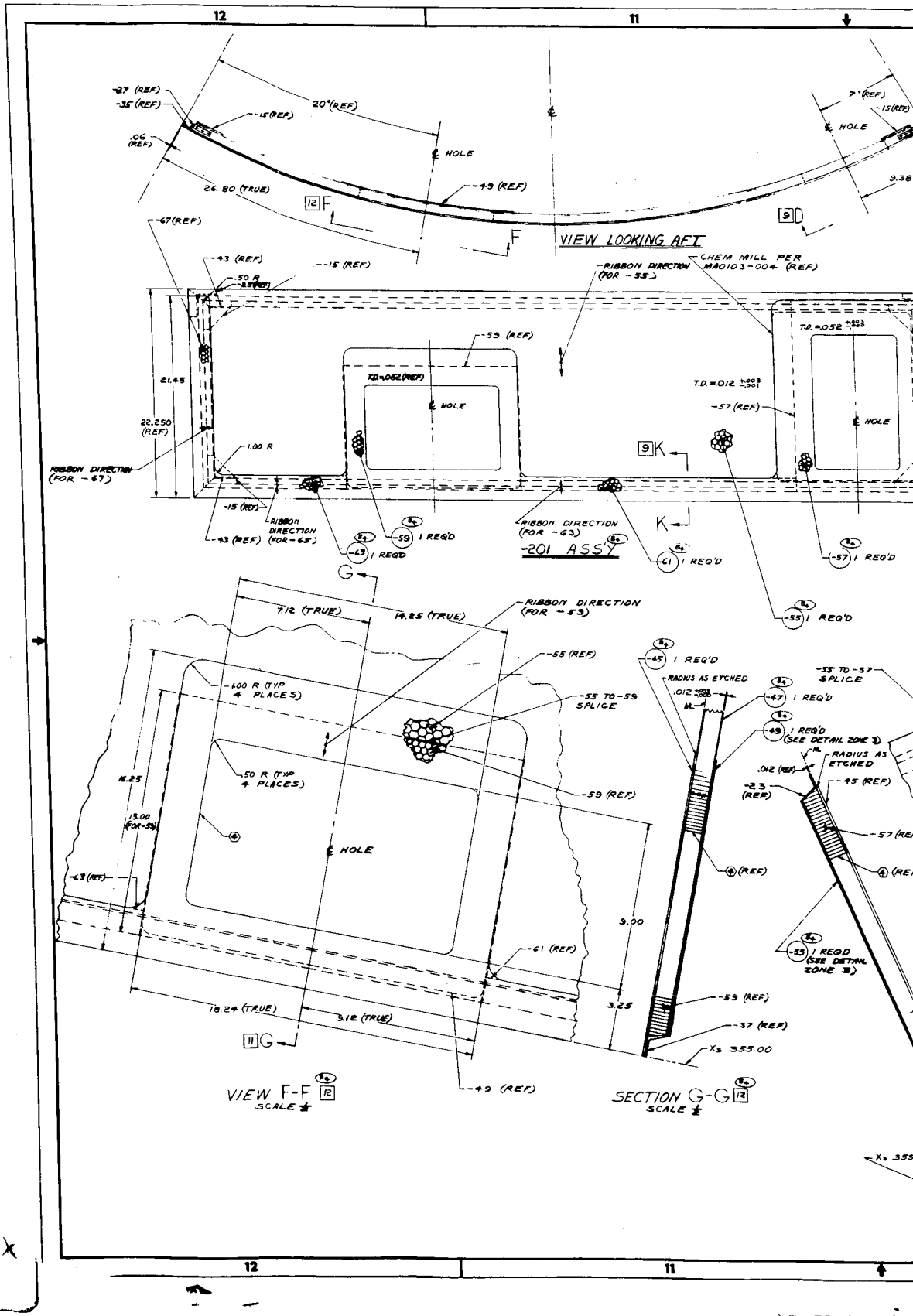
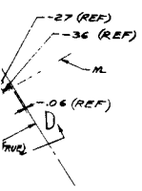
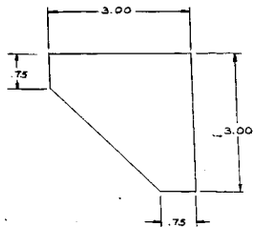


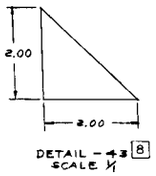
Figure 7-2. Installation of Fairing (V17-310001-2)


12
11
.27 (REF)
.35 (REF)
.06 (REF)
.15 (REF)
20° (REF)
℄ HOLE
26.80 (TRUE)
.49 (REF)
12 F
F
VIEW LOOKING AFT
7° (REF)
9 D
3.38
.67 (REF)
.43 (REF)
.50 R
.15 (REF)
CHEM MILL PER MA0103-004 (REF)
RIBBON DIRECTION (FOR -55)
T.D.=.052 +.003 -.001
.59 (REF)
I.D.=.052 (REF)
T.D.=.012 +.003 -.001
.57 (REF)
21.45
22.250 (REF)
1.00 R
9 K
RIBBON DIRECTION (FOR -67)
.15 (REF)
.43 (REF)
RIBBON DIRECTION (FOR -65)
-63 1 REQ'D
-59 1 REQ'D
RIBBON DIRECTION (FOR -63)
-201 ASSY
-61 1 REQ'D
-57 1 REQ'D
-58 1 REQ'D
G
7.12 (TRUE)
14.25 (TRUE)
RIBBON DIRECTION (FOR -59)
.55 (REF)
.00 R (TYP 4 PLACES)
-55 TO -59 SPLICE
.50 R (TYP 4 PLACES)
16.25
13.00 (FOR -59)
-59 (REF)
HOLE
.63 (REF)
-61 (REF)
9.00
3.25
18.24 (TRUE)
3.18 (TRUE)
11 G
.49 (REF)
VIEW F-F
SCALE
-45 1 REQ'D
RADIUS AS ETCHED
.012 +.003 -.006
-55 TO -57 SPLICE
-47 1 REQ'D
-49 1 REQ'D (SEE DETAIL ZONE 3)
RADIUS AS ETCHED
.012 (REF)
2.3 (REF)
.45 (REF)
.57 (REF)
(4) (REF)
-53 1 REQ'D (SEE DETAIL ZONE 3)
.55 (REF)
.37 (REF)
Xs 355.00
SECTION G-G
SCALE
Xs 355
12
11

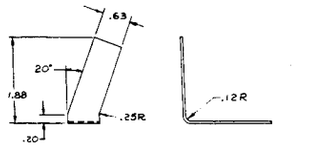


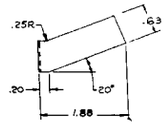


DETAIL - 15
SCALE ½ 8

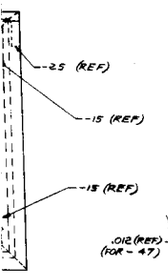


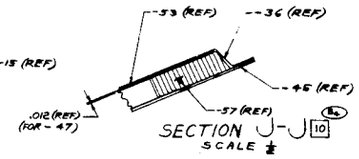
DETAIL - 43 8
SCALE ½



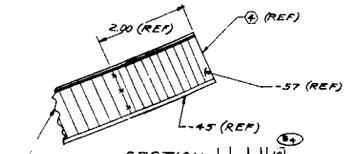


DETAIL - 27
SCALE ½ 9

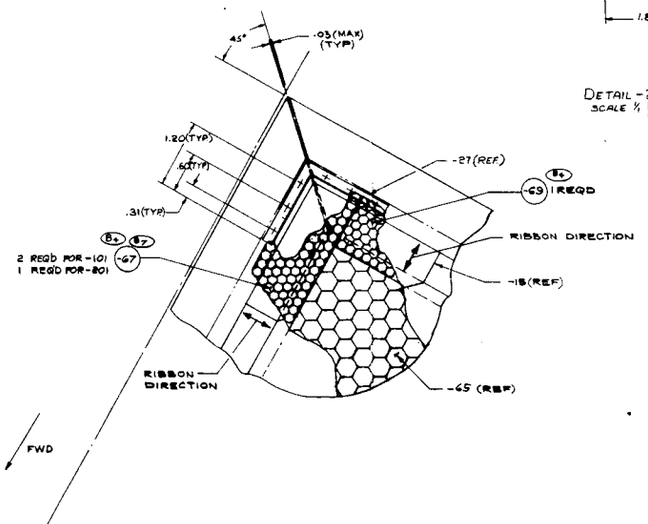




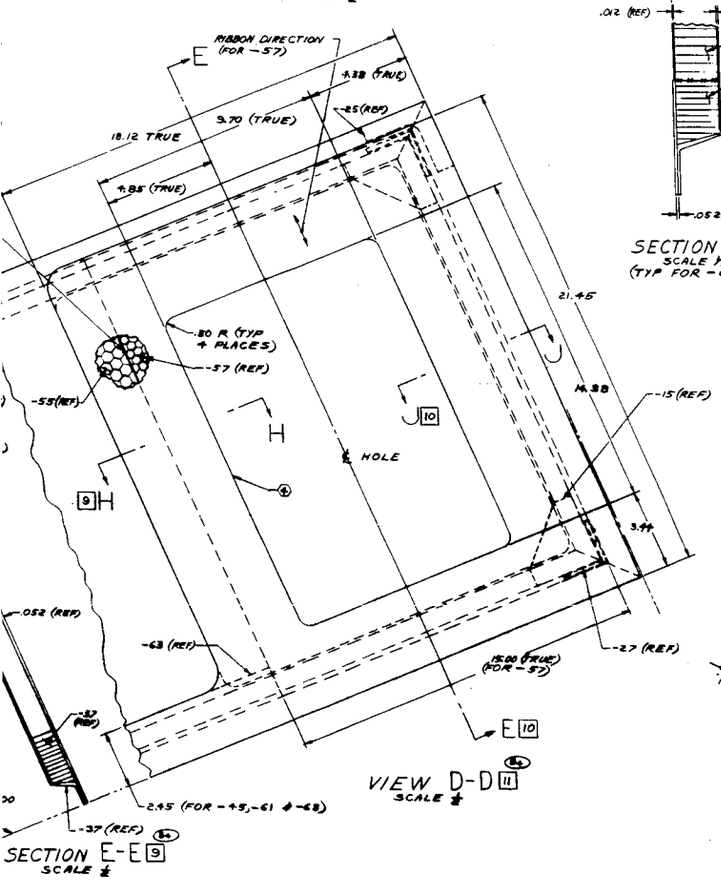
SECTION J-J 10
SCALE ½



SECTION H-H 10
SCALE ½

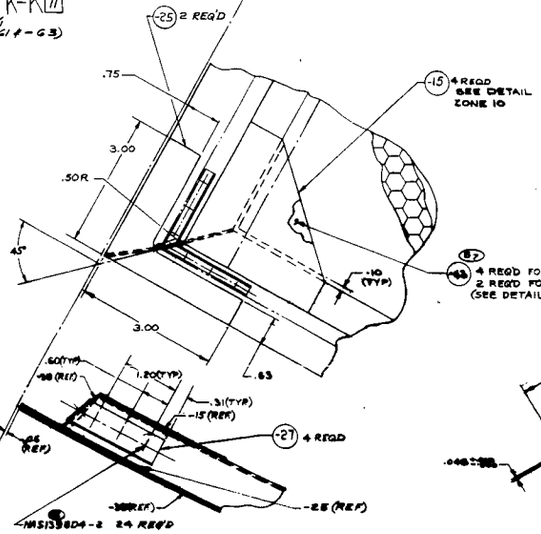


SECTION K-K 11
SCALE ½
(TYP FOR -61 & -63)

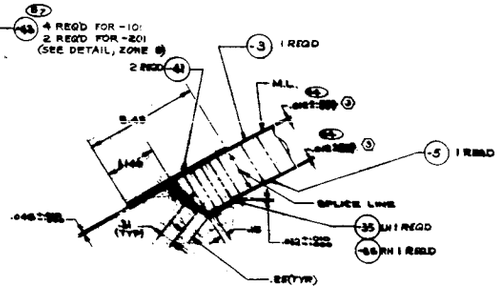


VIEW D-D 11
SCALE ½

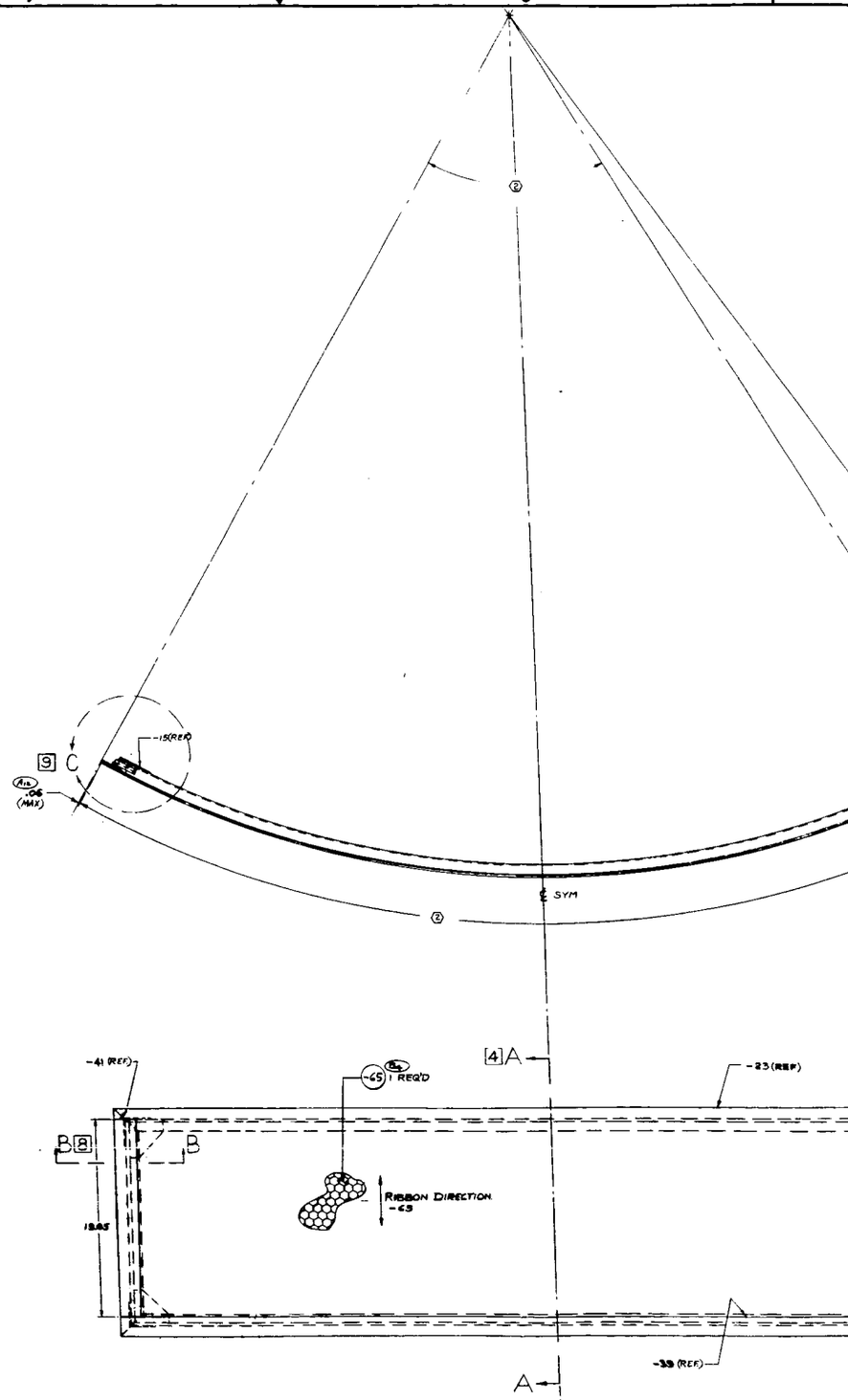
SECTION E-E 9
SCALE ½



DETAIL C 7
SCALE ½

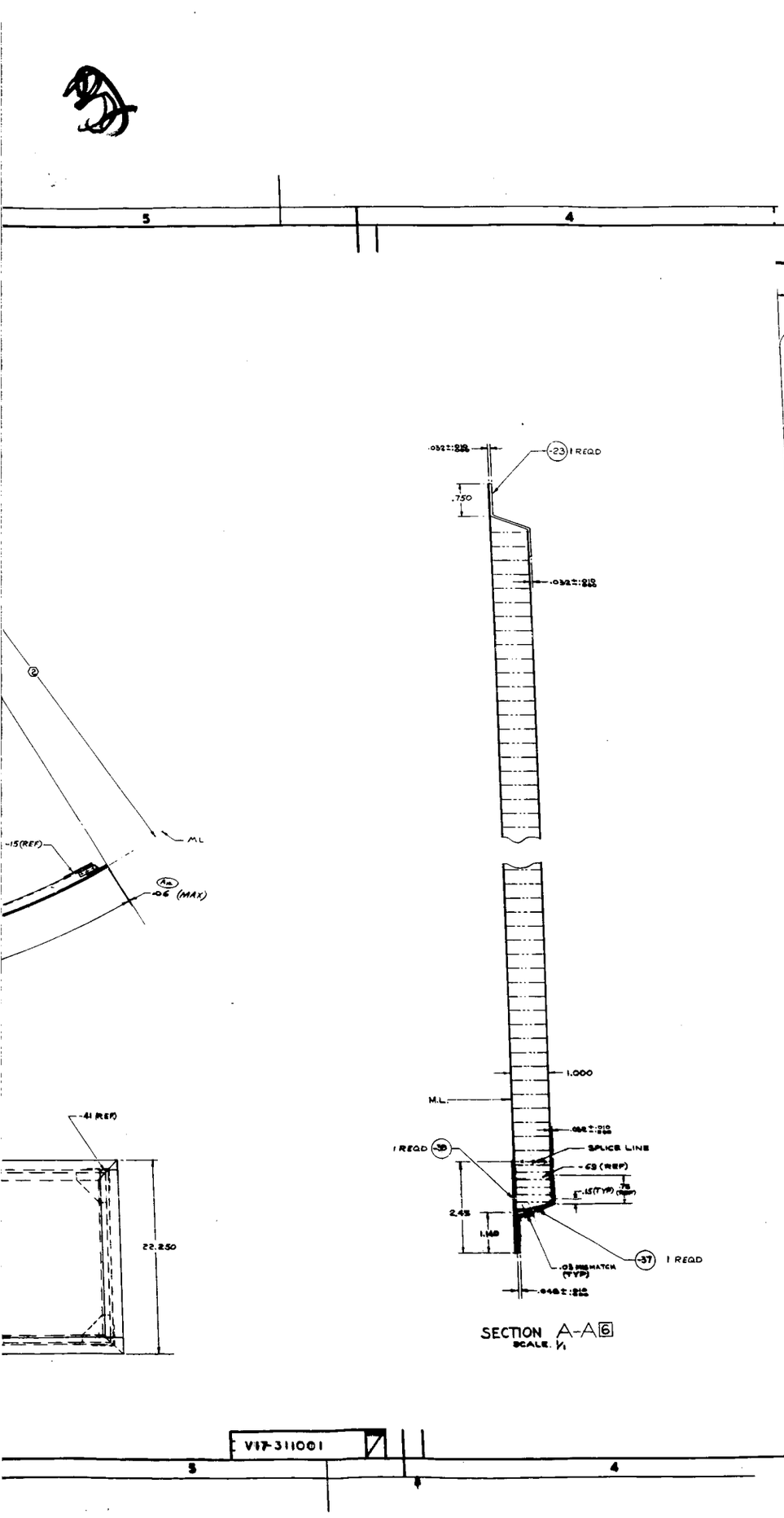


SECTION B-B 7
SCALE ½



-101 ASS'Y

V17-31001



SYM	ZONE	REVISIONS DESCRIPTION	DATE	APPROVED
		1. MAY BE REWORKED 3. RECORD CHANGE 2. CANNOT BE REWORKED 4. NON SHOP PRACTICE 5. PARTS MADE OK	TYPICAL	
A	F/D	1. ESTABLISED AND ADDED -51 REQUIREMENTS	3	
	L/M			
	U/B	2. DELETE BASIC REQUIREMENTS	3	
	U/B	3. ADDED B17-300018 TO U/B	5	
	B	4. IN SECTION B-B, .015-.035 WAS .012-.034	5	
	3	5. NAS1895D6-8 WAS MS20600M4W2	5	
B	L/M	1. IN DET-23, MS043-6521-0003 WAS MS043-6521-003.	3	
	L/M	2. DET-41 WAS .040X2.50X2.50	3	
	L/M	3. DELETED -51 & REQMTS, & -25,-31 & -33	3	
	4 & 6	4. ADDED -101 & -201 REQMTS, & -45,-47, -49,-51,-53,-55,-57,-59,-61,-63,-65,-67	3	
	3	5. ADDED NOTE #9 & #10	3	
	2	6. ADDED -101 & -201 REQMTS TO U/B	3	
	8	7. DET-67 WAS -31. 2 REQD;	5	
	10	DET-43 WAS 4 REQD	5	
	2	8. REMOVED END ITEM #1 ON MODEL V17-3 TO U/B	3	E.O. 92830
	2	9. ADDED END ITEM #11 ON MODEL V17-3 TO U/B	3	
	L/M	10. ADDED HEAT TREAT NOTE	3	
	L/M	11. FOR -23 & -37, 7075-O TEMP O WAS 7075-T6 TEMP T6	5	
	5,7	12. .06 MAX WAS .030 EFFECT ON: ITEM #11 & 12, REL	5	

QTY	QTY	QTY	QTY	QTY	REF DES	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT	MATERIAL	DATA: SPECIFICATION SIZES, NOTES, SUPPLIERS	ZONE	LINE NO.
24	24					NAS1398D4-2	BLIND RIVET				9	040
												039
												038
												037
												036
												035
		1				-69	CORE				8	034
		1	2			-67	CORE				8	033
		1				-65	CORE				6	032
		1				-63	CORE				12	031
		1				-61	CORE				11	030
		1				-59	CORE				12	029
		1				-57	CORE				11	028
		1				-55	CORE				11	027
		1				-53	DOUBLER				11	026
		1				-49	DOUBLER				11	025
		1				-47	FACING SHEET				11	024
		1				-45	FACING SHEET				11	023
		2	4			-43	DOUBLER				10	022
			2			-41	DOUBLER				8	021
			1			-39	DOUBLER				4	020
		1	1			-37	CLOSEOUT				4	019
		1	1			-35	CLOSEOUT				5	018
											8	017
											8	016
											8	015
											8	014
		+	+			-27	CLIP				5	013
		2	2			-25	DOUBLER				4	012
		1				-23	CLOSE OUT				4	011
											8	010
											8	009
											8	008
		4	4								5	007
											5	006
											5	005
											5	004
											5	003
											7	002
											8	001
												000
		-201	-101			V17-311001	ASSY OF					
							-5	FACING SHEET				
							-3	FACING SHEET				

LIST OF MATERIAL OR PARTS LIST

HEAT - 2.8-37 to T6 TREAT COND PER MIL-H-6088 (MA0111-001)
FINISH V14-000024

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS .XX± .03, .XXX± .010, ANGLES ±30', HOLES NOTED "DRILL" .228 THRU .500 +.004 -.000, .501 THRU 1.250 +.006 -.000, 1.251 THRU 2.500 +.008 -.000, 2.501 THRU 3.750 +.010 -.000, 3.751 THRU 5.000 +.012 -.000, 5.001 THRU 6.500 +.014 -.000

DR BY S. JOYLES 1/14/63
CHK BY
APPROVED BY (MAA)

NORTH AMERICAN AVIATION, INC. SPACE and INFORMATION SYSTEMS DIVISION 12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

FAIRING PANEL-SERVICE MODULE TO COMMAND MODULE, ASSY OF

CODE IDENT NO. 03953 SIZE J V17-311001

SCALE NONE SHEET

DO NOT SCALE PRINT

ITEM	QTY	MODEL	NEXT USING DRAWING	END ITEM NO.	THRU
REMOVE PER END ITEM				EFFECTIVE ON	

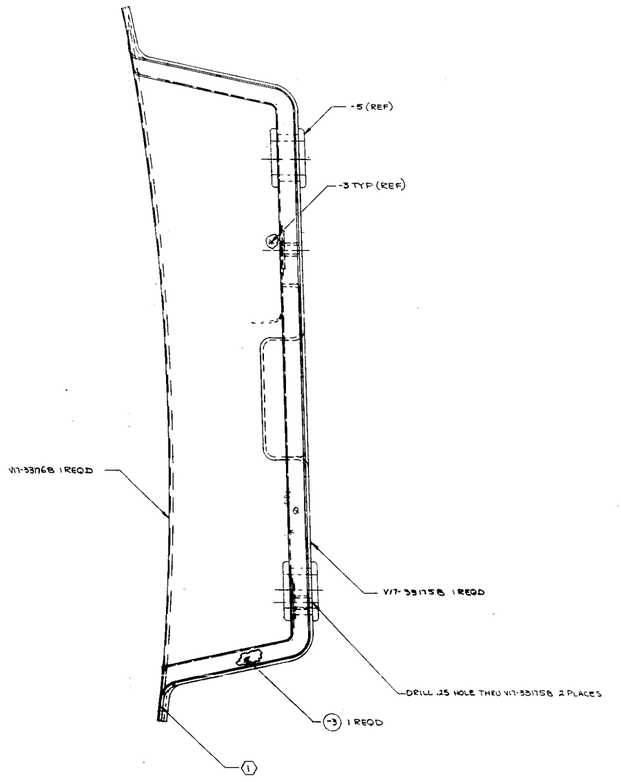
APPLICATION (USAGE) DATA

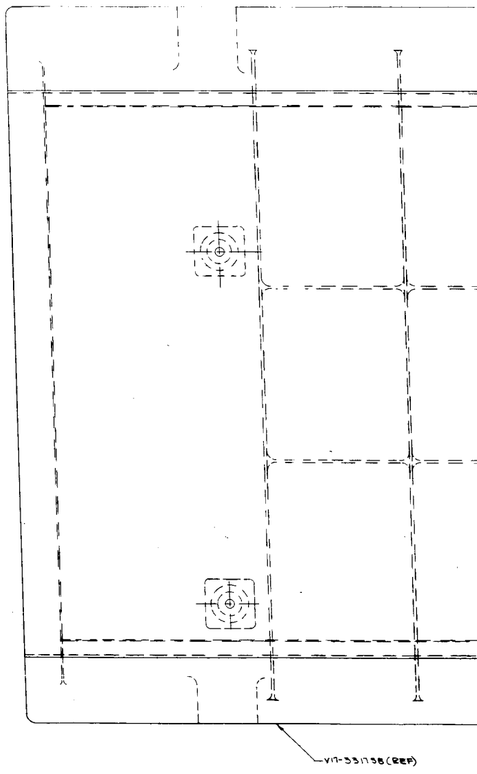
T.D. = THICKNESS DIMENSION.
④ 5. APPLY TYPE I FILLER TO ALL EXPOSED EDGES PER LA0106-008
B. INSTALL RIVETS PER LA0101-004
② 7. FOR CONTOURS & DIMS NOT SHOWN SEE MD-V14-17
4. STANDARD DETAILS PER FA507-5
5 MACHINE PER MA0103-005
③ 4 CHEM. MILL PER MA0103-004 AND/OR MACHINE PER MA0102-005
3 IDENTIFY PER LA 0104-003
2. FABRICATE DETAILS PER LA0102-004 &. BOND ALL DETAILS PER MA0106-002
① 1. RIBBON DIRECTION SHOWN IN F/D ZONE 6

NOTES: UNLESS OTHERWISE NOTED

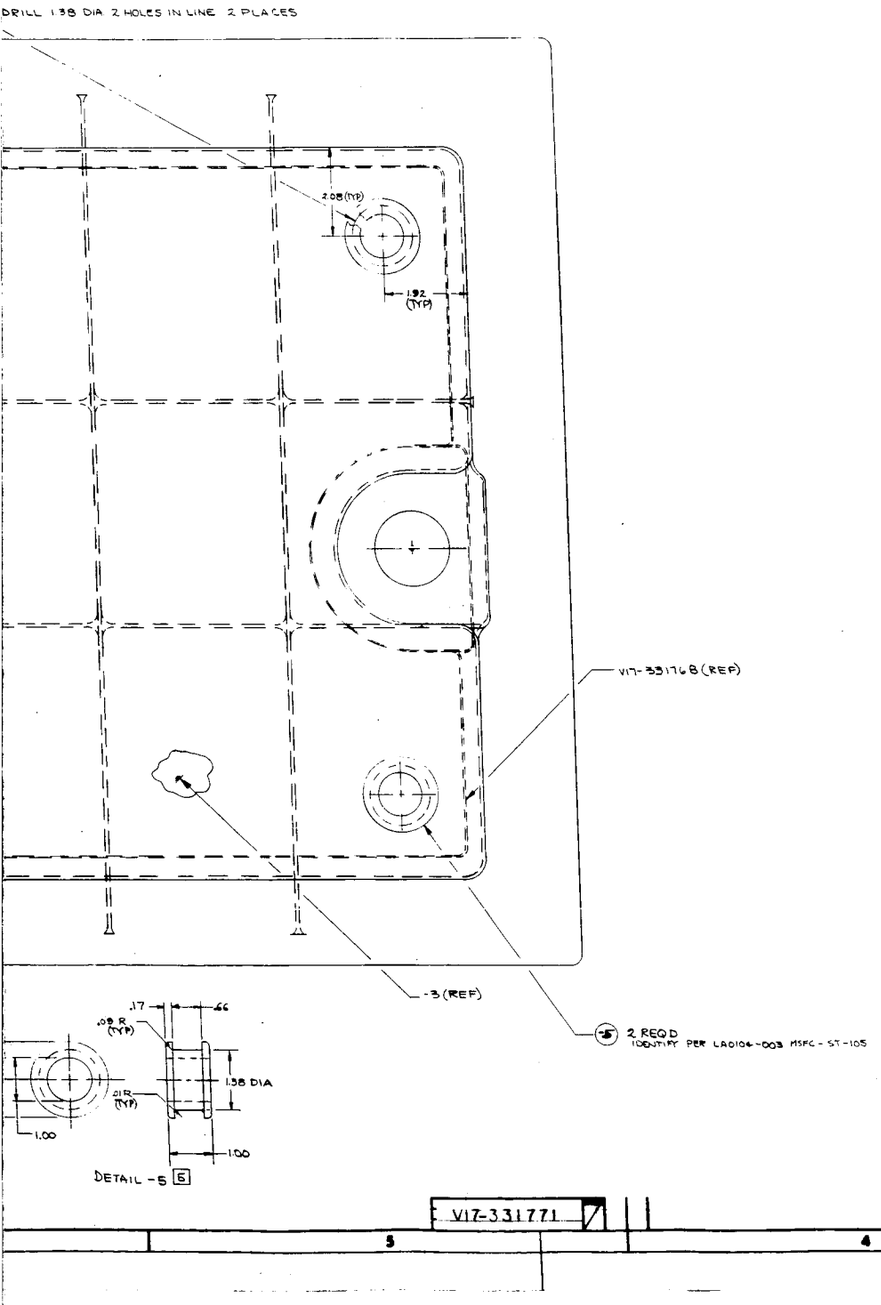
V17-311001

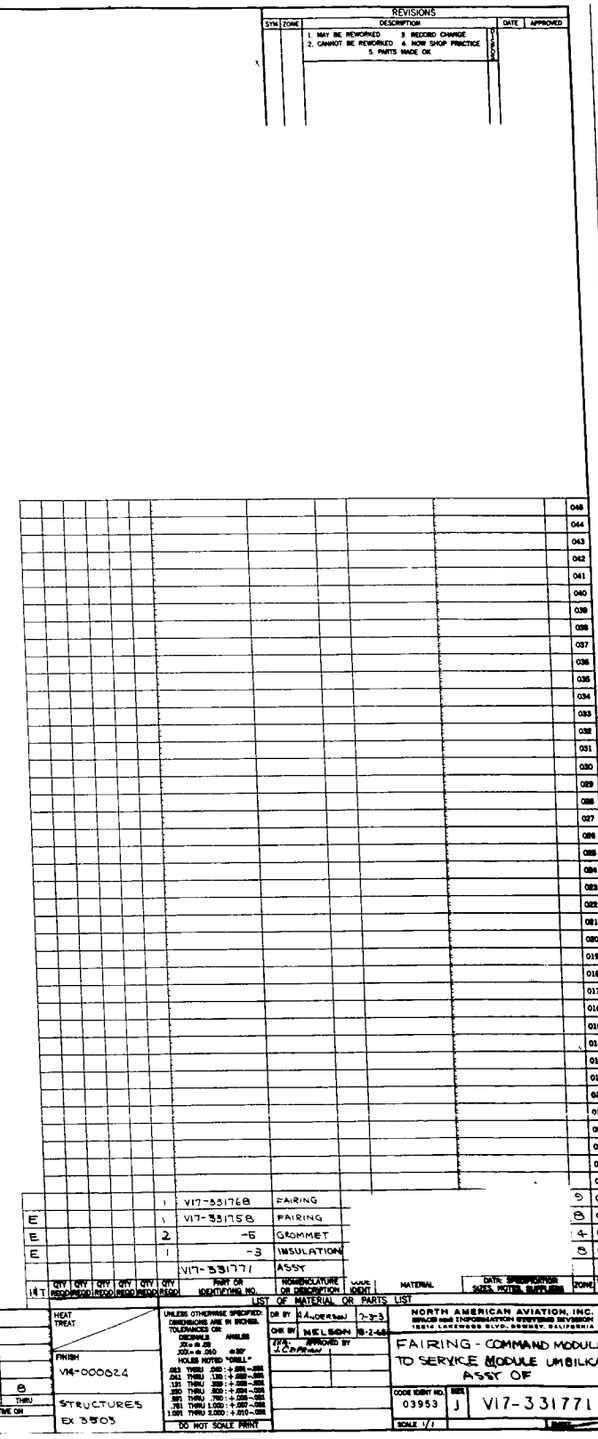
Figure 7-3. Fairing Panel Assembly, Service Module to Command Module (V17-311001)


-5 (REF)
-3 TYP (REF)
V17-331768 1 REQD
V17-331758 1 REQD
DRILL .25 HOLE THRU V17-331758 2 PLACES
-3 1 REQD
1


V17-331758 (REF)

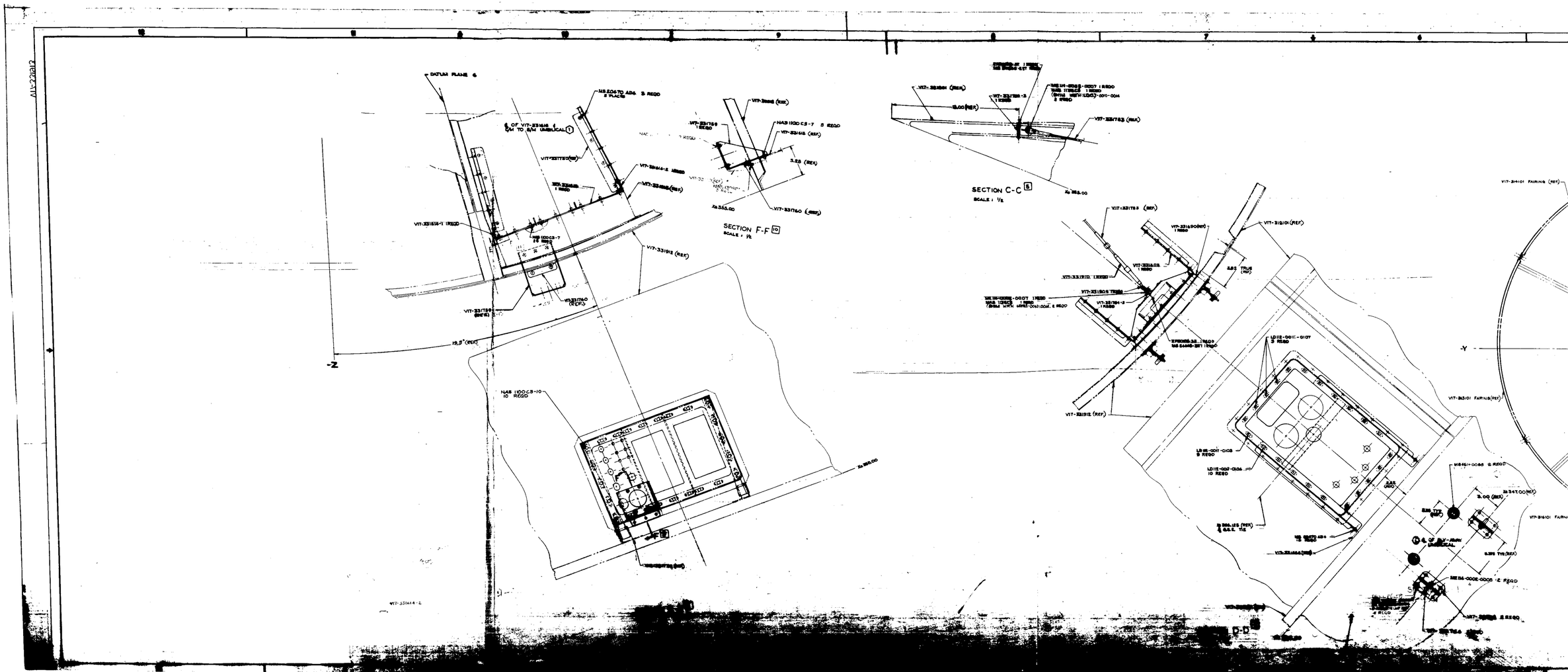
V17-331771

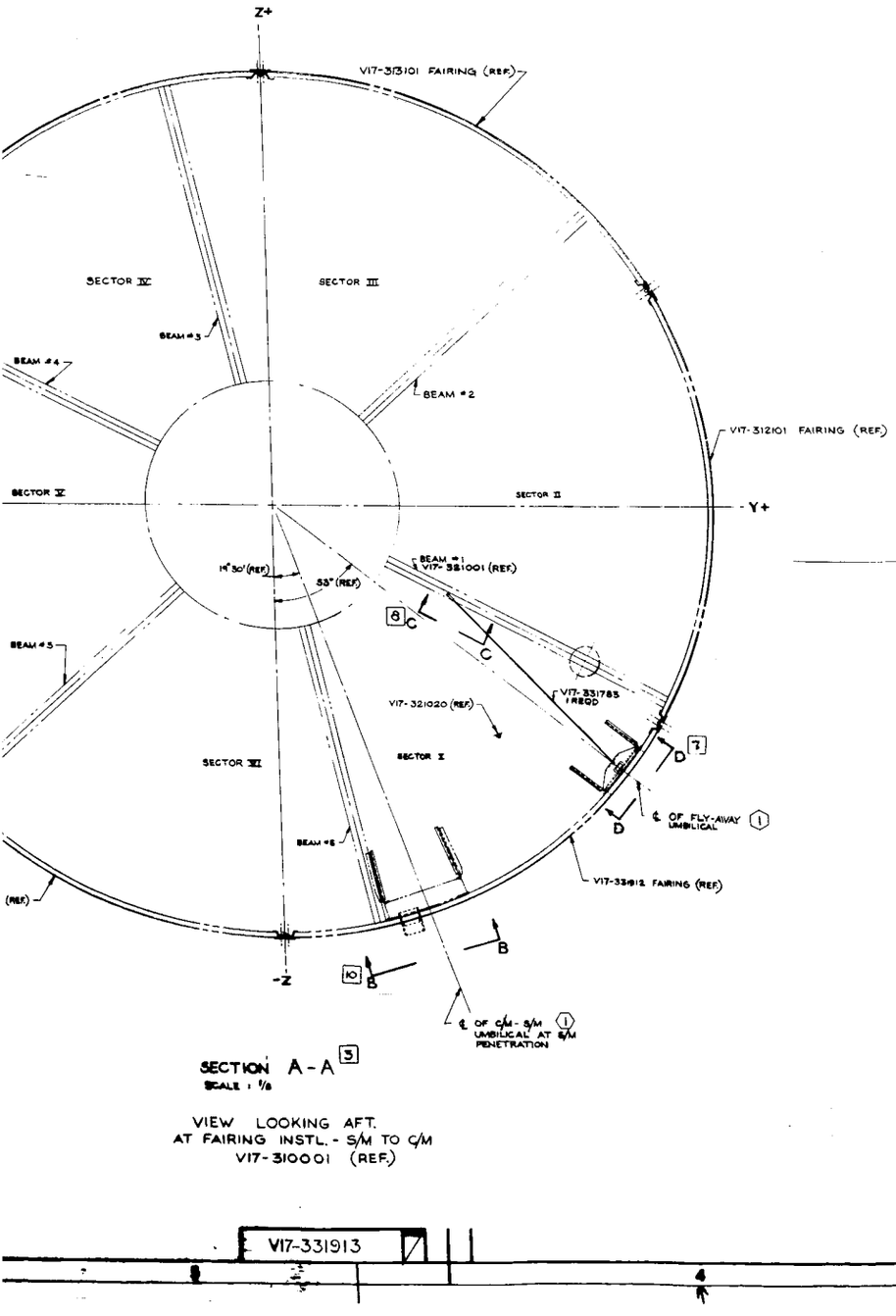




(1) 2 BOND V17-331768 TO V17-331758 PER MA-0106-002
FABRICATE PER SPEC MA0105-002
NOTES: UNLESS OTHERWISE SPECIFIED

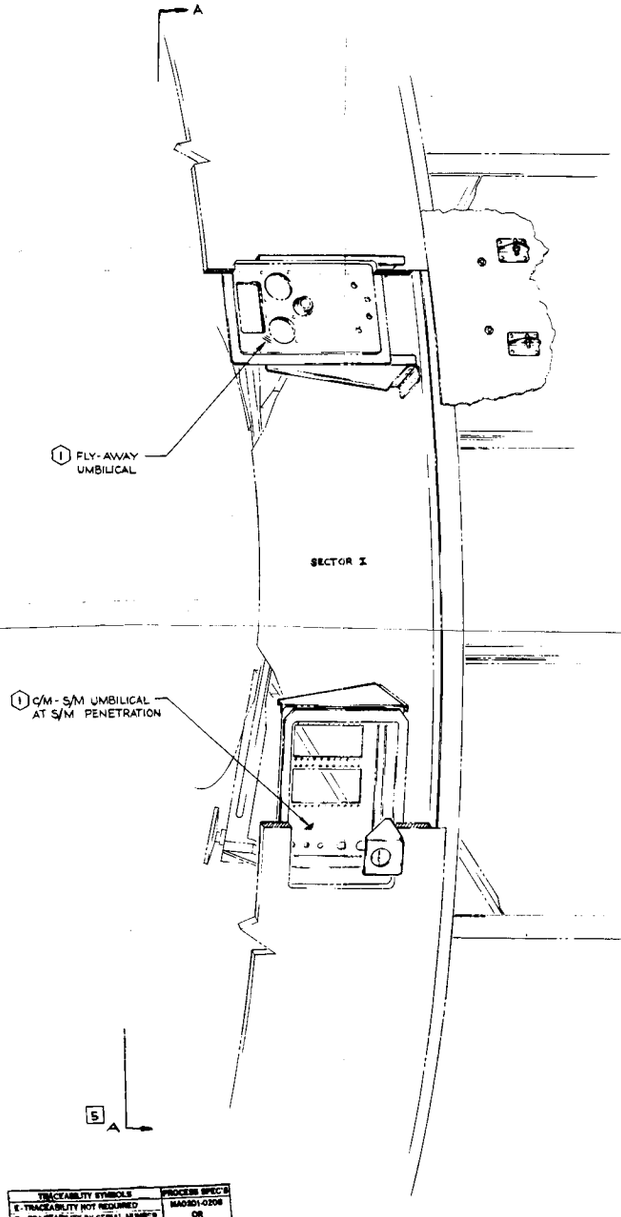
Figure 7-4. Fairing Assembly Complete, Command Module to Service Module Umbilical (V17-331771)


DATUM PLANE 6
MS 20670D 4D6 5 REQD 5 PLACES
6 OF V17-331615 4 EA TO B/M UMBILICAL 1
V17-331780(REF)
V17-331614-2 REQD
V17-331615-1 (REQ)
V17-331912 (REF)
V17-331780 (REF)
V17-331789 (REF)
19.9" (REF)
-Z
NAS 1100C3-10 10 REQD
Xs 355.00
SECTION F-F 10
SCALE : 1/2
V17-331789 1 REQD
V17-331645 (REF)
3.28 (REF)
Xs 345.00
V17-331760 (REF)
SECTION C-C 5
SCALE : 1/2
Xs 355.00
V17-331912 (REF)
V17-331901 (REF)
V17-331910 1 REQD
V17-331905 1 REQD
V17-331914-2 1 REQD
LD12-0011-0107 2 REQD
LD12-0007-0106 10 REQD
LD11-0011-0103 2 REQD
V17-331664 (REF)
V17-314101 FAIRING (REF)
V17-313101 FAIRING(REF)
-Y
D-D
6 OF V17-331615 4 EA TO B/M UMBILICAL
6.375 TYP (REF)
2 REQD



SECTION A-A 3
SCALE : 1/8

VIEW LOOKING AFT. AT FAIRING INSTL. - S/M TO C/M V17-310001 (REF.)



TRACEABILITY SYMBOLS	PROCESS SPEC'S
E - TRACEABILITY NOT REQUIRED	MA0301-0208 OR MA0301-0209
T2 - TRACEABILITY BY SERIAL NUMBER	
T1 - TRACEABILITY BY LOT NUMBER	

NOTES: UNLESS OTHERWISE SPECIFIED
1. SEE MD V14-17
2. INSTALL RIVETS PER MA0101-006
3. INSTALL THREADED FASTENERS PER MA0101-005

REVISIONS

SYM	ZONE	DESCRIPTION	DATE	APPROVED
		1. MAY BE REWORKED 2. RECORD GRADE 3. CANNOT BE REWORKED 4. NOW SHOP PRACTICE 5. PARTS MADE OK		

QTY REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT	MATERIAL	FIN	DATA: SPECIFICATION SIZES, NOTES, SUPPLIERS	ZONE	LINE NO.
2		ME461-0008	JACK, GROUND			E		6	088
1		2P50183-47	PIN			E		8	027
1		2P50183-55	PIN			E		7	026
4		LD158-0010-0014	WASHER			E		8	085
3		LD112-0011-0107	SCREW			E		7	084
10		LD112-0011-0104	SCREW			E		7	083
9		LD112-0011-0103	SCREW			E		7	082
2		ME114-0002-0007	NUT			E		7,8	081
2		ME114-0002-0005	NUT			E		6	080
8		ME114-0002-0004	NUT			E		6	079
8		NAS1183C19	SCREW			E		6	078
2		NAS1136C57	BOLT			E		8	077
10		NAS1100C3-10	SCREW			E		10	076
19		NAS1100C3-7	SCREW			E		9,10	075
2		MS24665-227	PIN, COTTER			E		7,8	074
1		V17-331910	BARREL TURNBUCKLE			E		7	073
1		V17-331909	FORK TURNBUCKLE			E		7	072
1		V17-331784-5	RETAINER			E		7	071
1		V17-331784-3	RETAINER			E		8	070
1		V17-331783	CABLE			E		4	068
2		V17-331765	ANGLE			E		6	066
2		V17-331764	STUD			E		6	067
1		V17-331759	BRACKET			E		9	066
1		V17-331616	PLATE			E		10	065
1		V17-331614-2	BRACKET			E		10	064
1		V17-331614-1	BRACKET			E		10	063
1		V17-331608	PLATE			E		7	062
		V17-331913	SUPPORT			E			001

LIST OF MATERIAL OR PARTS LIST

NEXT ASSY | USED ON | APPLICATION (USAGE) DATA

ITEM	QTY	MODEL	NEXT USABLE DRAWING	EFFECTIVE ON
	1	V17-5	V17-000005 E	—

NEXT ASSY: USED ON: APPLICATION (USAGE) DATA: ITEM QTY MODEL NEXT USABLE DRAWING V17-000005 E EFFECTIVE ON — SEND FROM NO. V17-5 SEND PER SHD ITEM

HEAT TREAT | FINISH | DESIGN & STRUCTURES 625 - 455

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ON: DECIMALS ANGLES .XX ± .03 ±30' .XXX ± .010 ±10' HOLES BORED "DRILL" .453 THRU .500 +.005 -.000 .391 THRU .452 +.004 -.000 .323 THRU .390 +.003 -.000 .261 THRU .322 +.002 -.000 .201 THRU .260 +.001 -.000 .126 THRU .200 +.001 -.000 1.000 THRU 1.500 +.010 -.000

DO NOT SCALE PRINT

DR BY M.STEINSTRA 10-28-65
CHK BY
APPROVED BY K.V.COATE
DESIGN - D.R. PETERSON

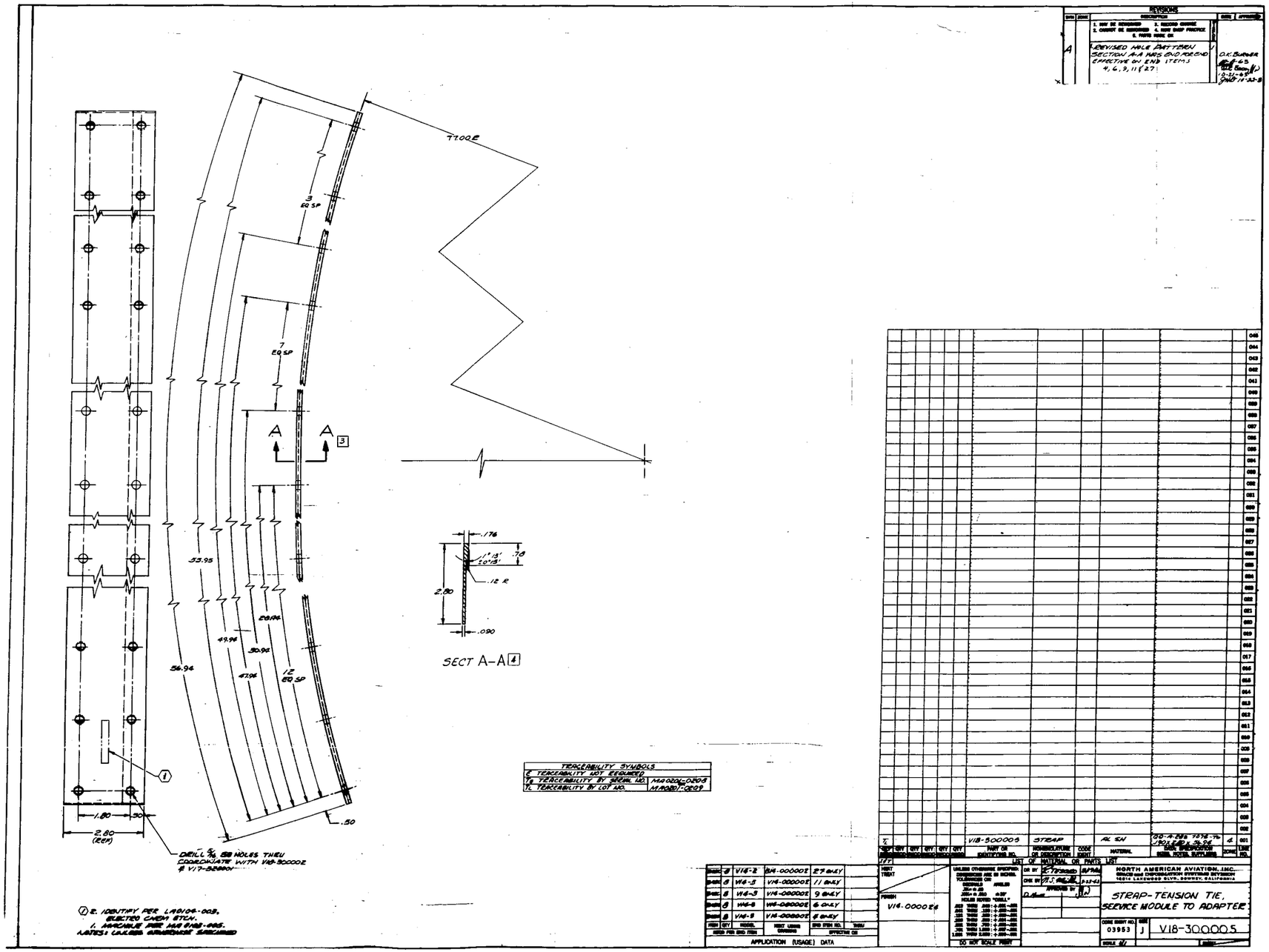
NORTH AMERICAN AVIATION, INC. SPACE and INFORMATION SYSTEMS DIVISION 12214 LAKEWOOD BLVD. DOWNEY, CALIFORNIA

SUPPORT - COMMAND TO SERVICE MODULE & FLY-AWAY UMBILICAL, ASSY OF.

CODE IDENT NO. 03953 | SIZE J | V17-331913 | SCALE NOTED | SHEET

V17-331913

Figure 7-5. Assembly of Support - Command Module to Service Module and Fly Away Umbilical (V17-331913)



1. IDENTIFY PER LAB104-003, ELECTRO CHEM ETCH.
2. MARKABLE PER MIL-STD-130.

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 7-6. Strap-Tension Tie, Service Module to Adapter (V18-300005)

7.2.4 A fourth external interface concerns the S/M and Adapter-to-Launch Complex or the GSE umbilicals. Drawing V17-933401 (Figure 7-7) presents the control layout for the servicing and umbilical locations. The latter are blown away hydraulically from their respective structures at time of blast-off. (S-1 configuration only; S-5 configuration now in design study.)

7.2.5 Design studies are now in progress for the following external interfaces:

a. S/M to SLA;
b. SLA to Saturn instrument package;
c. S-IV B adapter to LEM;
d. S-1 Adapter to S-IV B.

7.3 Internal Interfaces

7.3.1 One of the two internal interfaces is between the ECS and the EPS. Drawing V17-331549 (not included) exhibits a bracket mounting which binds members of each system.

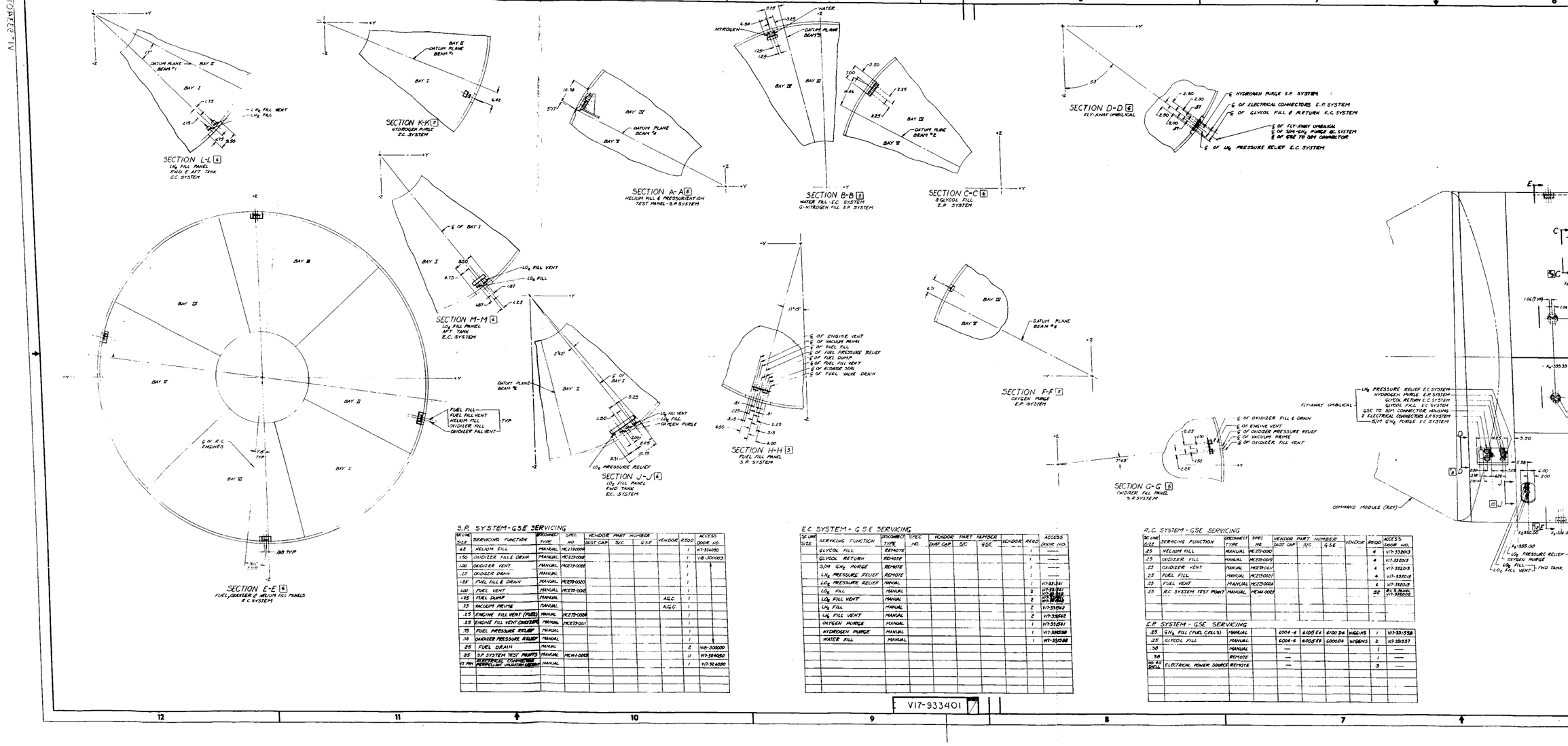
7.3.2 A second internal interface is between the SPS and the EPS. Drawing V17-331501 (not included) likewise shows a bracket mounting for members of each respective system.

7.4 Test Requirements

7.4.1 Tests for interfaces have been scheduled chiefly for separation systems involving the modules. The test schedule given below is included in this manual for information purposes. Only the first three tests have been completed.

7.4.2

ATR NO.	NAME OF TEST
100 A	Separation System: C/M from S/M
101	Separation System: S/M to S-IV B Adapter
101-1	S/M Adapter Panel Ejection System
101	Supplement 1 - Separation System, S/M to S-IV B Adapter
101 A	Separation System: S/M from Adapter



S.P. SYSTEM-GSE SERVICING

SEQ LINE SIZE	SERVICING FUNCTION	DISCONNECT TYPE	SPEC NO	VENDOR PART NUMBER DUST CAP	S/C	G.S.E	VENDOR	REQD	ACCESS DOOR NO.
.62	HELIUM FILL	MANUAL	MC273-0004					1	V17-324050
1.50	OXIDIZER FILL & DRAIN	MANUAL	MC273-0008					1	V18-300003
1.00	OXIDIZER VENT	MANUAL	MC273-0012					1	
.25	OXIDIZER DRAIN	MANUAL						1	
1.25	FUEL FILL & DRAIN	MANUAL	MC273-0010					1	
1.00	FUEL VENT	MANUAL	MC273-0010					1	
1.25	FUEL DUMP	MANUAL					AGC	1	
.35	VACUUM PRIME	MANUAL					AGC	1	
.25	ENGINE FILL VENT (FUEL)	MANUAL	MC273-0006					1	
.25	ENGINE FILL VENT (OXIDIZER)	MANUAL	MC273-0011					1	
.75	FUEL PRESSURE RELIEF	MANUAL						1	
.35	OXIDIZER PRESSURE RELIEF	MANUAL						1	
.25	FUEL DRAIN	MANUAL						2	V18-300000
.25	S.P. SYSTEM TEST POINTS	MANUAL	MCH-0005					11	V17-324050
12 PIN	ELECTRICAL CONNECTOR RECEPTACLE (VALVE DRAIN)	MANUAL						1	V17-324050

E.C. SYSTEM-GSE SERVICING

SEQ LINE SIZE	SERVICING FUNCTION	DISCONNECT TYPE	SPEC NO.	VENDOR PART NUMBER DUST CAP	S/C	G.S.E	VENDOR	REQD	ACCESS DOOR NO.
	GLYCOL FILL	REMOTE						1	——
	GLYCOL RETURN	REMOTE						1	——
	SIM GH_2 PURGE	REMOTE						1	——
	LH_2 PRESSURE RELIEF	REMOTE						1	——
	LO_2 PRESSURE RELIEF	MANUAL						1	V17-333541
	LO_2 FILL	MANUAL						2	V17-333541 V17-333542
	LO_2 FILL VENT	MANUAL						2	V17-333541 V17-333542
	LH_2 FILL	MANUAL						2	V17-333542
	LH_2 FILL VENT	MANUAL						2	V17-333542
	OXYGEN PURGE	MANUAL						1	V17-333541
	HYDROGEN PURGE	MANUAL						1	V17-333538
	WATER FILL	MANUAL						1	V17-333538

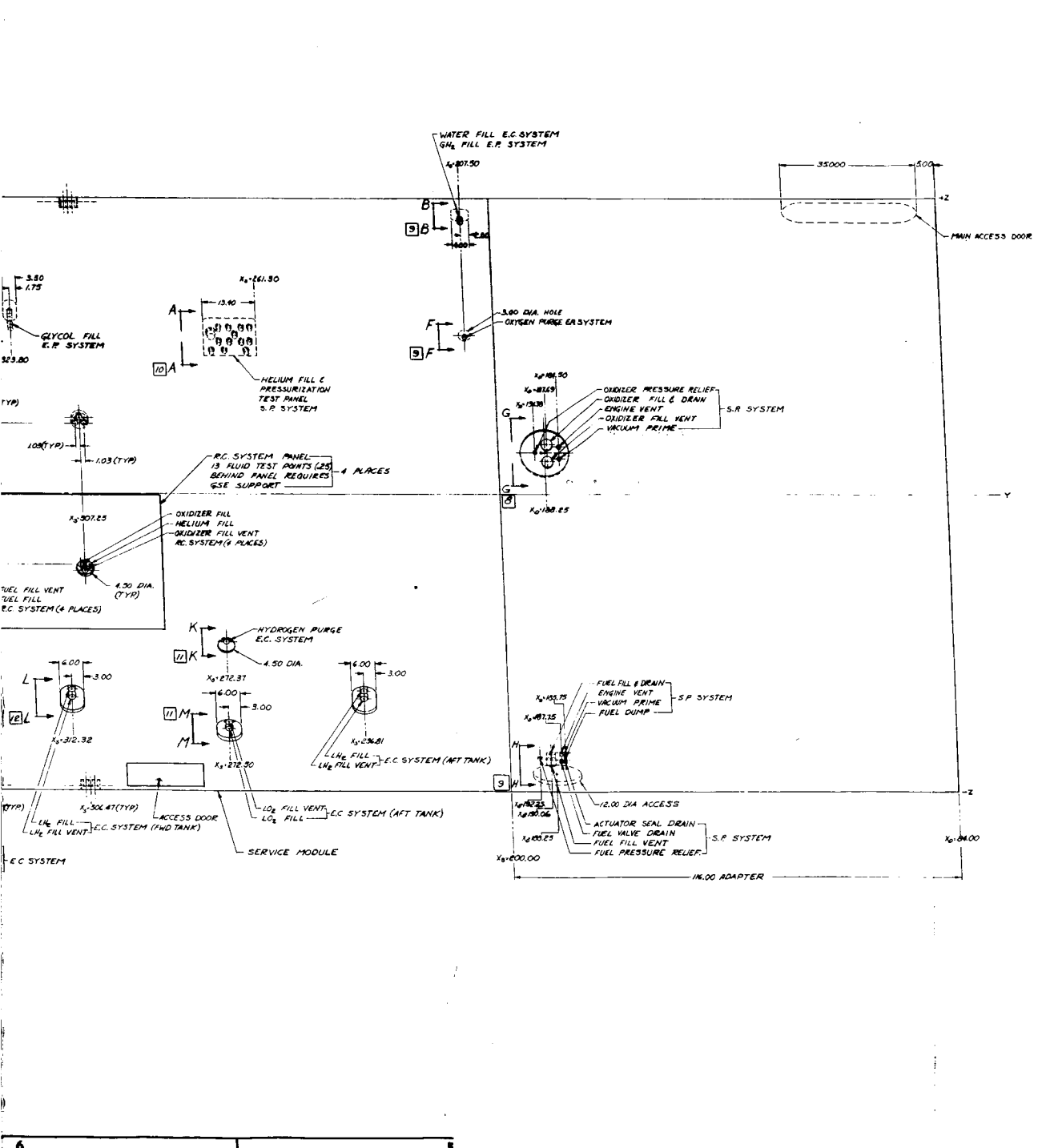
R.C. SYSTEM-GSE SERVICING

SEQ LINE SIZE	SERVICING FUNCTION	DISCONNECT TYPE	SPEC NO.	VENDOR PART NUMBER DUST CAP	S/C	G.S.E	VENDOR	REQD	ACCESS DOOR NO.
.25	HELIUM FILL	MANUAL	MC273-0010					4	V17-332613
.25	OXIDIZER FILL	MANUAL	MC273-0019					4	V17-332613
.25	OXIDIZER VENT	MANUAL	MC273-0011					4	V17-332613
.25	FUEL FILL	MANUAL	MC273-0021					4	V17-332614
.25	FUEL VENT	MANUAL	MC273-0024					4	V17-332613
.25	R.C. SYSTEM TEST POINT	MANUAL	MCH-0009					32	R.C.S. Panel V17-332614

E.P. SYSTEM-GSE SERVICING

SEQ LINE SIZE	SERVICING FUNCTION	DISCONNECT TYPE	SPEC NO.	VENDOR PART NUMBER DUST CAP	S/C	G.S.E	VENDOR	REQD	ACCESS DOOR NO.
.25	GH_2 FILL (FUEL CELLS)	MANUAL		6004-4	6105 E4	6100 D4	WIGGINS	1	V17-333158
.25	GLYCOL FILL	MANUAL		6004-4	6002 E4	L2000 D4	WIGGINS	2	V17-333537
.38		MANUAL		—				1	——
.38		REMOTE		—				1	——
10-42 DATA	ELECTRICAL POWER SOURCE	REMOTE		—				3	——

V17-933401



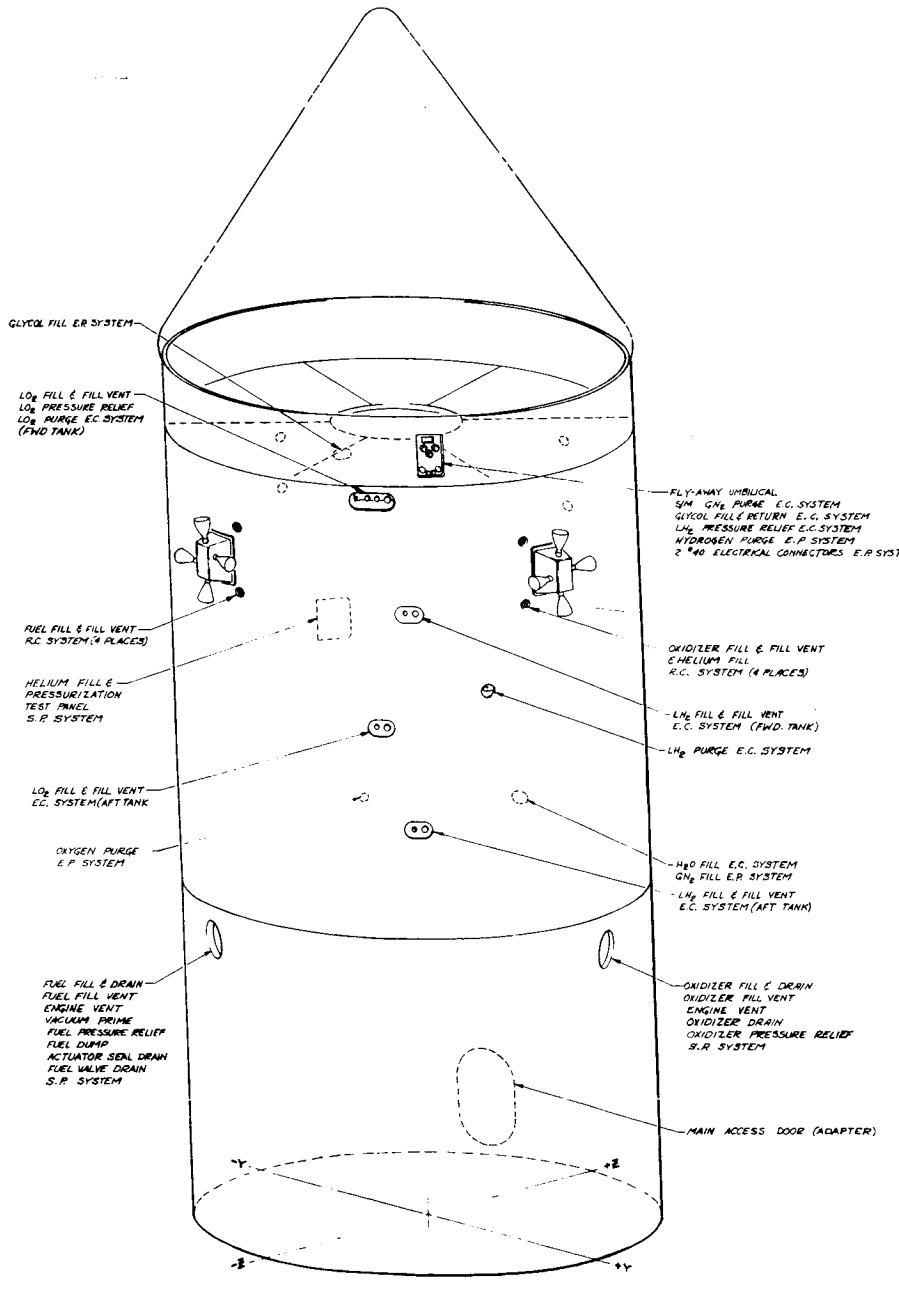


Figure 7-7. Control Layout for Servicing and Umbilical Locations (V17-933401)

8.0 REFERENCES*

8.1 IOL AE-1-62-313, dated 5 December 1962, from C.H. Feltz, Department 695-100, to Apollo Engineering Management, on subject of Apollo Engineering Manuals.

8.2 NASA Exhibit "B" Technical Specification, Part I. 3 January 1963.

8.3 Composite Construction for Flight Vehicles, Part III, Design Procedure, MIL Handbook 23.

8.4 Apollo Test Requirements Status and Coordination List. NAA S&ID, 17 July 1963.

8.5 Command Module and Launch Escape System Structures. DIM-8, Apollo Systems Engineering Manual. NAA S&ID, 7 August 1963.

8.6 General Test Plan, Research and Development for Project Apollo Spacecraft, Individual System Test. NAA S&ID, SID 62-109-2.

*Add all current control, perspective, and nomenclature drawings as called out in the list of illustrations for this manual.

ILLUSTRATION LOG

PROJECT DESIGN INFORMATION MANUAL DIM-9

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	2-8	Complete Interior Arrangement of Service Module (V17-935561-2)	2-9		✓
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	2-11	Assembly of Aft Bulkhead, Station X_S 200 (V17-320201-2)	2-13		✓
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	2-13	Assembly of Aft Bulkhead, Station X_S 200 (V17-320201-4)	2-15		✓
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	4-3	Tank Assembly Complete: Main Propellant, Fuel (V17-343001)	4-4		✓
	4-4	Tank Assembly: Main Propellant, Oxidizer (V17-342002)	4-5		
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	5-8	Panel Assembly, Reaction Control System (V17-332002-1)		✓
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	5-10	Housing Assembly, Reaction Control System (V17-332010)		
	5-11	Longitudinal Heat Shield Installation, Reaction Control System (V17-331535)		✓
	5-12	Lateral Heat Shield Installation, Reaction Control System (V17-331611)		✓
	5-13	Insulation Installation for Reaction Control System (V17-332046)		✓
	5-14	End Mounting Assembly of Propellant Tanks, Reaction Control System (V17-332041)		✓
	5-15	Mounting Assembly, Propellant and Pressure Tanks, Reaction Control System (V17-332042)		✓
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FORM 930-R-1

ILLUSTRATION LOG

PROJECT DESIGN INFORMATION MANUAL DIM- 9

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	6-5	Insulation Installation Provisions, Service Module (V17-331562-1)	6-	7
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